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Everyone Can Help Win the War

In spite of the greatly increased traffic which the railroads have had to handle in recent months, the car shortage is not nearly so severe as it was, although it is many times greater than it ever has been at this time of the year. Undoubtedly traffic conditions will be far more severe in the coming months because of the large amount of material that will have to be handled in connection with the encampments for the men who are now being conscripted, and the large amount of material that will have to be shipped abroad to our army in France and to our allies. Our success in the war is dependent in a very large degree upon the successful operation of our transportation systems and nothing should be left undone to maintain the equipment in the best of condition and prepare during the coming months for the unfavorable weather conditions which will have to be overcome during the winter. The remarkable success that the railroads have already had is largely due to the loyalty and patriotic spirit of the officers and employees and the general co-operation which has been extended to the railroads on the part of the public and the government in helping to secure better car loading. Railway employees must not neglect to do their full duty in seeing that the best possible service is secured from the equipment and that it is maintained in such condition that it will be able successfully to stand the heavy service to which it will be subjected not only during the coming winter but during the duration of the war—and this promises to be not a matter of months but possibly of years. In a large measure the war has resolved itself into a business proposition and those who can contribute toward the better upkeep and operation of the railroads' transportation systems and the various industries are as important in the interest of a successful outcome as the men who will have to shoulder guns and fight in the trenches.

Mechanical Association Year Books

Practically every one of the railway mechanical associations have voted to postpone indefinitely their 1917 conventions. This was done because it was felt that the men could not be spared from their work. It is, of course, to be regretted that there will be no opportunity for the practical men to get together and discuss problems which are of so great importance at the present time. This can in a large measure, however, be obviated if every association will proceed as is its custom to publish a year book or official proceedings, including the papers that would have been presented at the convention. The General Foremen's Association has planned to publish its advance copies, in accordance with its past practice, and send them to the various members of the association with the request that each member study the papers carefully and send to the secretary written discussions concerning them. This plan could well be followed by other associations. After a definite date for the closing of the discussions, sufficient ma-

terial should be in the hands of the secretary to warrant the publication of the regular official proceedings. In this way the members of the association will have an opportunity of obtaining the ideas of others on important problems.

Every member of the associations which intend to follow this practice, should consider it his patriotic and individual duty carefully to study the various subjects and send to the secretary his best thoughts and information regarding them.

Transporting Material in Shops

The scarcity of labor makes it necessary to study closely the merits of any device that may be introduced into railroad shops with a view to conserving time and human energy. During the past few years a number of railroads have used electrically operated trucks for transporting material in and about shops with great success. The ease and rapidity with which these can cover the ground and negotiate sharp curves and the saving which they make possible in the number of laborers required about the shop are of extreme importance at this time. If necessary, a boy can operate them; in one railway storehouse in Canada a woman was observed in charge of one of these trucks. In a great many instances, and particularly in storehouses, trucks so arranged that the bodies can be elevated can be used to great advantage with special platforms. Material can be piled on these platforms and the body of the truck can be run under them, the platforms elevated and transported to another part of the shop, leaving the truck free to be used for other purposes while the platforms are being loaded and unloaded.

Better Operation of Locomotives

Never has such a heavy and prolonged stress been placed on the locomotives of this country, and the end of this abnormal situation is not in sight. It will last at least until the end of the war, and it is becoming more and more recognized that this may be a matter of years. The power must not be allowed to fail no matter how great this stress may become or how severe the coming winter may be; and it is vital also that the fuel which is used be conserved to as great an extent as possible. Every officer and employee in the operating and mechanical departments can do his share in helping to operate with the greatest possible economy and efficiency; but a specially heavy responsibility rests upon the shoulders of officers such as traveling engineers, road foremen of engines, traveling firemen, and those having similar duties. The men on the locomotive must be fully educated in the proper performance of their duties and as to the extreme importance of the transportation systems in winning the war. This can best be accomplished by personal contact and by showing the men in detail exactly how they can better their performance. The weakest spots in the force should be tackled first and simple methods must be adopted to let the men realize that their good and their bad points are recognized. Good performance should be commended and poor performance patiently studied so that the best means may be found to improve it. The traveling supervisors of locomotive operation and the engineers and firemen should also realize that the easiest way of overcoming trouble is by preventing it. A little energy exerted when defects first appear will often prevent heavy expense and holding the engine out of service later. Co-operate also with the engine house foreman and help him; do not criticise and approach him in a fault-finding spirit. His job is no easy one at any time and, particularly at the present time, it is no bed of roses. With more work and responsibility than he has ever had before, he is confronted with all sorts of labor and material troubles. Stand back of him with your help and influence; do not heckle or hamper him. In so doing you will be rendering a real patriotic service to your fellows and your country.

Car Men and the Car Shortage

The Railway War Board a few months ago issued a strong appeal to the railroads to reduce the car shortage by loading cars to their capacity and by keeping to a minimum the number of cars undergoing repairs in shops. This appeal has been admirably answered and despite the abnormal business the railroads have been making a better showing. The work of the car foremen and car inspectors will have a direct bearing on how successfully the railroads meet the nation's needs. They are the men on the firing line who must challenge the enemy "defect." As the United States has joined the Allies in Europe and offered of her resources that the war might be won, so must the car repair forces ally themselves to the general cause of more cars and safe cars and "give to foreign cars, while on its line, the same care * * * * that it gives to its own cars." Never before did M. C. B. Rule 1 mean as much as it means today. There are no "home cars." There are no "foreign cars." There are "our country's cars."

On June 1 the net car shortage was 105,000 and although this was a decrease of 30 per cent under the shortage on May 1, it was 1,300 per cent greater than the largest previous shortage reported for the same month. The demands for equipment are unprecedented and with the heavy burden of military traffic in the late summer and fall the demands will be greater. The backbone of the railroads is equipment. The cars must be safe to operate; they must be strong enough to carry their full burden and there must be enough of them. The men in the trenches on the battlefield are offering their lives for their country. The men in the trenches of the railroad field can show their patriotism and valor by sticking to their jobs and putting the best they have into making the equipment serve its purpose, do its duty and carry supplies to those who are giving their lives.

Fuel Department Organization

Elsewhere in this issue is published a description of the fuel department organization of the Rock Island which is of particular interest in that the officers of the department rank as general officers and the department has full control of the purchase, inspection, distribution, handling and consumption of the fuel. It brings all fuel matters under one central head, that head having sufficient power to insure the different problems that arise in fuel matters being solved to the best interests of the railroad. Generally speaking, fuel has been considered largely a mechanical department matter. It is a fact that the mechanical department is responsible for the consumption of the fuel; it is supposed to get the most it can out of each pound of fuel and for this reason is supposed to make any savings in fuel that may be made. There is no question that the mechanical department can by proper instruction of its engine crews and by keeping the steaming qualities of its locomotives up to standard, keep the fuel bill down, but beyond that its hands are tied.

There is a great deal more to the fuel problem than burning the fuel. While large economies can be made by proper methods of firing and by good locomotive design, there are great possibilities for economies in the purchase, distribution and handling of the fuel. It should, therefore, be apparent that by bringing these matters under one head better all-around results will be obtained. It is far easier to convince an officer who is responsible for all fuel matters that certain grades of coal should be used on certain divisions than to convince an officer who is only responsible for the money spent for fuel. It is also easier to co-ordinate all the various problems entering into decreased fuel bills by

holding one department responsible than by having the responsibility spread over various departments.

Need for the Utilization of Scrap

For several years past much interest has been shown in the reclamation of scrap and many railroads have gradually built up extensive plants for the repairing and reworking of the numerous classes of material which accumulate at the scrap yards. During this development attention has been directed in these columns to the danger of overzealousness in reclaiming scrap material. Because of a lack of an adequate system of accounts, figures for the cost of reclaimed material often have been inaccurate and have led to the extensive use of material which could have been purchased new in the open market to better advantage. This situation, however, has been remedied in a large measure by the introduction of better accounting methods and more careful supervision of the work of scrap reclamation, and at the present time the great need is for a more extensive use of reclaimed material than has ever before been attempted. Owing to the unusual demand for iron and steel products of all kinds, much difficulty is being experienced and will continue to be experienced in securing necessary materials for use in maintaining both cars and locomotives, in quantities sufficient to meet the demand. Wherever such material may be secured from the scrap yard, its use may be of considerable advantage in assuring a continuous and adequate supply of certain classes of material, irrespective of the cost of working it over in the reclamation plants. However, with many of the materials involved showing increases in price during the past two years of anywhere from 100 per cent to 300 and 400 per cent, no fear need be felt as to the financial justification of such a policy.

No matter how extensively reclaimed material may be used, there are always large quantities of material passing through the scrap yard which must be sold. The prospects are that during the coming winter the demand for many classes of scrap material will be unusual because of the inability to secure an adequate supply of ore from the Lake Superior mines before lake navigation closes. The railroads being among the large sources of scrap supply may, therefore, perform an important service by seeing to it that all useless material is collected and sent to the scrap yard, where it may be available for the market as the need arises.

Keeping the Valuation Up-to-Date

The problem of devising a method of keeping the valuation of shop equipment and rolling stock up-to-date is one which is troubling the mechanical departments of the roads that have completed the valuation. It is extremely difficult to secure enough clerks to do the work properly, yet it is essential that the valuation be kept up-to-date in order that it shall never be necessary to duplicate what has already been done. The methods followed by the roads in the past in keeping a record of charges to capital account will not satisfy the requirements of the Interstate Commerce Commission. In the majority of cases where past records have been checked in connection with the valuation work it has been shown that the systems formerly in use did not result in the proper charges being made. Many items properly chargeable to capital account have been charged to maintenance of equipment. It is to the interest of the roads to keep the charges properly distributed and a careful check of any new system which is adopted should be made to see that it actually does insure correct distribution.

The charges for new shop equipment and rolling stock can usually be handled with comparatively little trouble, but the accounting system often fails to secure the proper division between the charges for repairs and those for additions and betterments to equipment. In handling these accounts it is often necessary to depart from the usual practice and provide some definite check on the work.

On one road a special arrangement has been made which it is believed will insure the correct separation of charges without making it necessary to employ a man to check the individual items. A record of the cost of making an addition or betterment to a single locomotive or car is carefully checked. The cost of this single operation and the amount chargeable to capital account are recorded as standard charges. The work done in the shops is not separated between the accounts at the time it is done but a record is kept of the number of cars or locomotives to which each addition or betterment is applied. At the end of the month the total charges to capital account are computed from the records of additions and betterments and the unit costs. The sum thus secured deducted from the total charges gives the amount to be charged to maintenance of equipment. A scheme of this sort could be used in nearly any shop with but slight expense and the results should be better than are obtained where charges are apportioned by the workmen or by shop clerks.

False Economy in Locomotive Repairs

The present scarcity of skilled railway mechanics creates a strong temptation to slight repair work in the shops in order to secure greater output. It seems necessary at this time to sound a warning regarding some of the short cuts that are now being put into practice. One of these methods of speeding up work which can hardly be called new but is now being used more extensively than heretofore is setting valves without putting rollers under the main wheels. There is no question that such procedure saves time but when locomotives are repaired they should be put into condition to operate at their maximum efficiency and this object is not secured unless the valves are set accurately.

The proportions of the valve gear which give the best results in locomotive service have been determined by careful experiment. If valves are set without determining any of the events and merely equalizing the travel, the benefits of correct design are lost. The slight amount saved in the shop by reducing the work involved in setting the valves is offset many times by the cost of the extra fuel consumed by locomotives which do not have the proper steam distribution. It may be argued the enginemen can determine by the sound of the exhaust whether the valves are set properly. At best, this is merely a check on the point of cut-off and is useful only in showing whether an equal distribution of power for each stroke is secured. It gives no indication as to the lead or the point at which cut-off takes place. Furthermore, locomotives equipped with superheaters are usually worked at such long cut-offs that irregularities cannot be determined by the sound.

Quite as bad as inaccurate methods of setting valves is the practice of deviating from standard dimensions at the whim of the valve setter or the enginemen. At one of the shops on an eastern road the man who was employed as valve setter had his own theories regarding the proper proportions for the valve motion. He maintained that plenty of lead made a smart engine, consequently he set the valves on all locomotives with 3/8 in. more lead than was specified in the standard instructions. This man had considerable prestige as a valve setter among the shop men and no one saw fit to insist that he adhere to the standard. If the effect of his practice on the fuel consumption of the locomotives had been apparent the valve setter would no doubt have seen the error of his policy.

It is unfortunate that railroads so seldom apply indicators to locomotives in order to determine the actual steam distribution. It seems probable that if indicator cards were taken periodically a marked gain in fuel economy would result. Unfortunately the roads are not in a position to put such a method into practice, particularly at this time. Every shop can, however, do its part to insure that fuel will be used economically by adhering to standards and by seeing that the valve motion is put in the best of condition.

COMMUNICATIONS

A FOREMAN'S PLEA

The West.

To the Editor:

Can your journal not use its influence against the shabby treatment that some railways accord their foremen in the matter of wage adjustments?

We see our men given increases in pay when conditions justify, but the foreman's wages are stationary, except for those on the hourly rate, who are legislated for by the labor organizations. Such grievances are the making of advocates of government ownership. As matters are now we seem to have no system of compensation, but the matter is left to the personal preferences or friendship of some person higher up.

A Foreman.

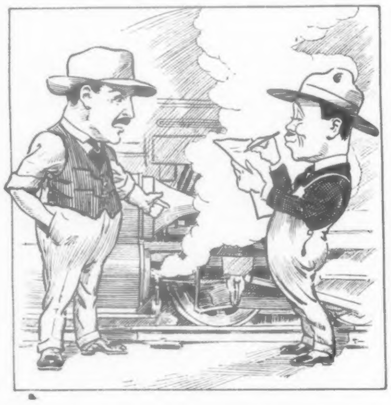
TOBESURA WENO "BACK ON THE JOB"

(With Apologies to Wallace Irwin.)

Chicago, Ill.

Dear Editor:

Since previous epistle, I am completely exonorate, restore to job with salute, profound assurance of faith my loyalty, honor and ability. Kind friends in office of Chief also present me with Iron Cross decorate with ribbons, although I are little worry about elaborate excuse for not displaying appropriate inscription. Friends say it constitute treason to U. S. A. to give real Iron Cross so substitute one made in America are present. In fact, accurate picture my decoration shown in Crane catalog page 593.



"It are not New Packing Imperial Government Desire to Inflict but Tight Joint."

My dealing with you are also excuse as Hon. Members of Congress declare that press must be free in glorious republic, that it shall not be gag like Russian vodka or Berliner Zeigfest.

On assuming job, I receive S. O. S. summons from secretary of Lodge 41,144 to help save overwork brothers. He advise engines all shot to pieces, roundhouse foreman won't do work and trainmaster working everybody to death so can't make garden and reduce high cost to live. I report on job Monday a. m. and immediately place five engine on Form 5 roll of honor relating following history on each:

Engine 421-R. drive flange 1-11/16 in. big wide gash in mud ring corner which are leaking and wearing hole in ashpan.

Engine 468.—Hole in stack which are also not sitting up straight, 6-in. flat spot on tender chafering iron, draw-pin have 1/8-in. slot wore up and down, angle bar in right back corner firebox instead of grate which are missing.

Engine 394.—Right side-bearing tank gone entire, cistern leaning on one side instead of both making dangerous condition, brake beam safety hanger bracket bolt thread strip and tap lost off.

Engine 381.—Lubricator dirty, water glass lime up so unintelligent to read, gage cock leaking on top stuck below, engineer seat box cushion spring resolutioniency missing and front cab window too dirty for vision.

Engine 413.—Reverse rod come back hard go ahead easy which make engineer lay off for lambago in back, two flues plug, patch leaking fierce, packing gone both piston rod and headlight insufficient in mean spherical candlepower.

I hope this report satisfy brother Secretary, but not so—he say mm won't do work and should come back tomorrow unexpected. I return as he require and first thing see whole front engine 413 envelope in steam. I commence to inscribe Form 5 when mm appear in excitement. He say wait and confiscate wandering machinist. We take stuffer box and cup out and he point triumphant to brand new packing. I reply it are not new packing imperial government desire to inflict on railroad but tight joint. He remark solo voice it can't be done. I resume writing while mm inquire uneasy about course. I converse gently explaining that rod wore 1/32 in. in hollow which require turning down and respectively make such recommendation on Form 5 which I hand out polite all the time grieving inward.

I are unable to see brother Secretary again, but hope he become satisfy over this cup-de-tete.

Yours truly, Tobesura Weno.

TOOLS FOR THE WORKMEN

Paris, France.

To the Editor:

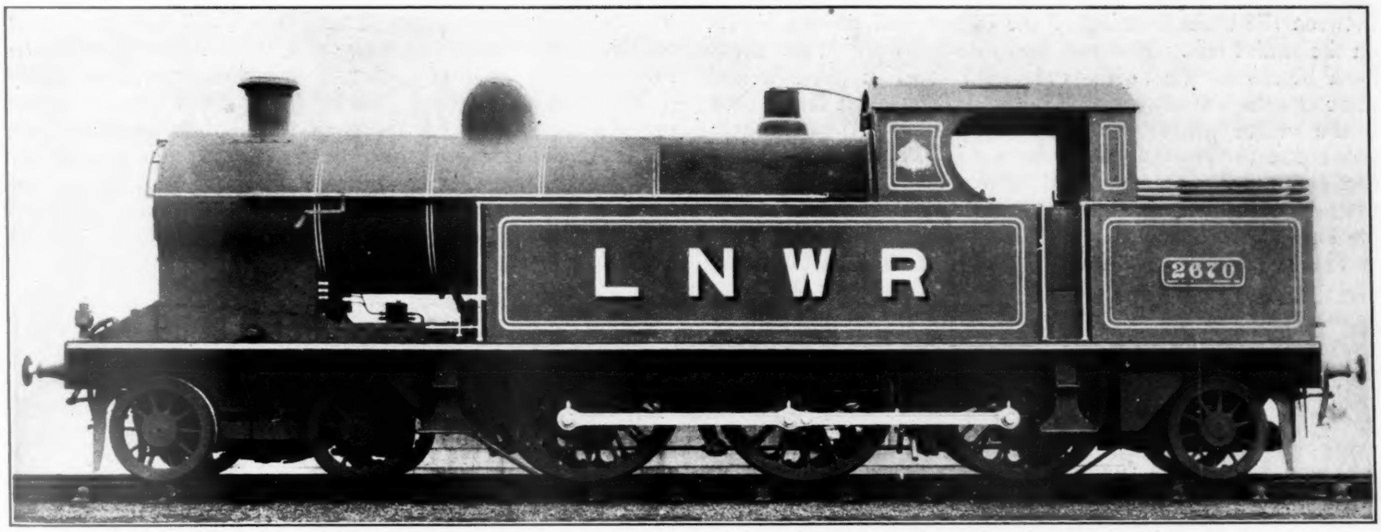
Having worked for many years in the shops of American railroads and thus being acquainted with the methods followed in supplying the workmen with the necessary working tools, I am taking this opportunity of telling how the French railroads handle this matter for the purpose of showing, what was in my case, a delightful contrast.

When I obtained work as a machinist in the shops of a French railway I was given a locker and a large tool drawer, both equipped with good locks. Then I went to the tool room and obtained a good number of files and chisels, center punch, hammer, goggles, two large cloths (used instead of waste and exchanged for fresh ones once a week), a pound of soft soap to wash with, and a list of all the things that were given to me. This list was to show what I was responsible for and, should I resign, the tools would be checked against it and any missing would have to be paid for. The tool room was splendidly equipped with everything a machinist could possible want and all tools were kept in first class shape. The best thing of all was the fact that no one did any stealing of tools and the consequence was much smoother working, less delay and less disputes. This also applied to locomotives—there was no robbing of one locomotive to supply the needs of another. A large bench was provided for the various parts removed from a locomotive and it was rare to find anything missing when the time came to put them back. The helpers received the same equipment as the machinists.

One good feature is that each gang foreman has his own supply of standard studs, bolts, nuts, washers and cotter pins, with the result that these things could be obtained quickly. The gang foreman is always sure to have the unused ones picked up to return to his cupboard. With the usual American system, the workman usually gets an order for more than he wants, so as to be on the safe side, then has to go perhaps a hundred yards or more to the storeroom to get the material and any nuts, etc., that are left over are usually swept up with the rubbish.

W. G. Landon.

Normal World Production of Coal.—A compilation made by the National City Bank gives the coal production of the world, during the recent normal years, as 1,500,000,000 tons, 38 per cent of which was produced in this country, 21 per cent in Great Britain and 20 per cent in Germany. Great Britain has exported 75,000,000 tons in normal years, the amount in 1916 having been reduced about half. The United States exported 31,000,000 tons in 1916.



Passenger Tank Locomotive, London & North Western

Modern British Tank Locomotives

Large Numbers of These Engines Are Used to Move Both Passenger and Goods Local Traffic

BY E. C. POULTNEY
Mem. Am. Soc. M. E.; A. M. I. M. E.

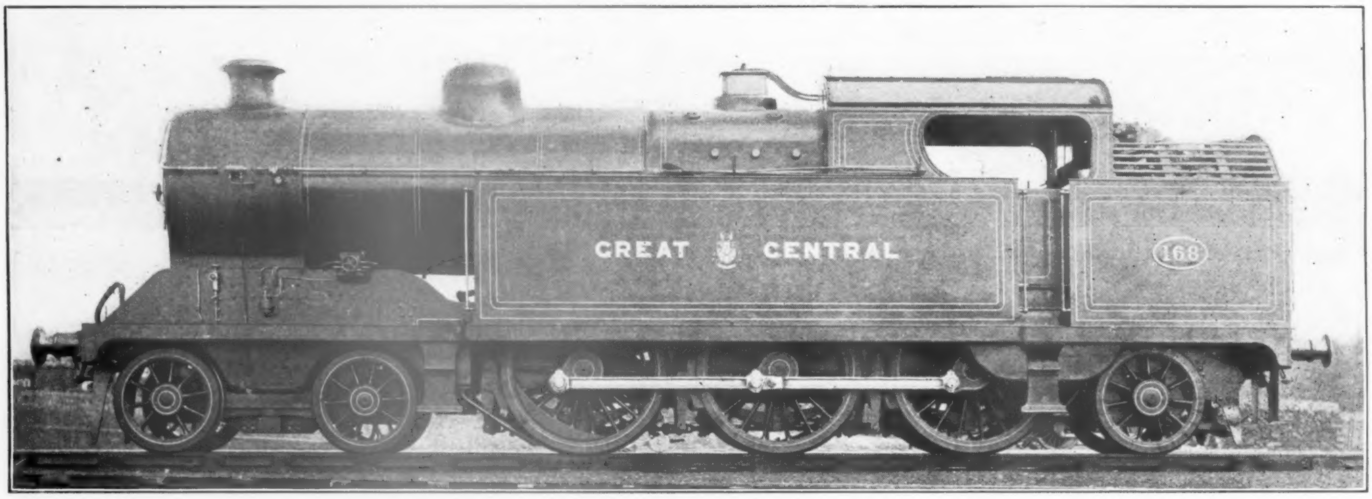
ALL the railways in Great Britain use considerable numbers of tank engines for local passenger and goods traffic and the tabulated statements of dimensions accompanying this article gives particulars of the wheel arrangements mostly favored at the present time, together with the principal dimensions of a number of modern engines. The most usual type of tank engine for passenger service till recently has been the 2-4-2 type, and large numbers are still to be found on most lines. Possibly the most notable example of this type of engine were those built by J. A. F. Aspinall for the Lancashire & Yorkshire, which line probably operates more passenger trains by tank engines than any other railway in England. Of the passenger train mileage on this road 56 per cent is operated by tank locomotives. These engines were the first to be built by Mr. Aspinall and were the first Lancashire & Yorkshire engines to be fitted with Joy's valve motion, which has been the standard on this line ever since. They had inside cylinders 18 in. by 26 in., 5 ft. 8 in. four-coupled wheels, leading and trailing radial axles, 1,216 sq. ft. of heating surface and a steam pressure of 160 lb. At the time of their introduction they were among the most powerful tank engines in Britain and did excellent work on a road running through a thickly populated country. Several of them have been rebuilt and fitted with the Belpair boilers, Schmidt superheaters and 20½-in. cylinders. So far as short distance goods traffic is concerned, the type of engine most used is the 0-6-2 design and nearly all railways have numbers of these engines. In general, they are not particularly large as a big boiler together with side tanks of ample water capacity cannot be carried on eight wheels, and a total heating surface of 1,300 sq. ft. and 18-in. cylinders marks the limit that can be reached with this wheel arrangement; hence, the 2-6-2, 4-6-0 and 4-6-2 types are finding favor, these designs being used for both passenger and goods traffic. Generally, the details of design follow the practice of the particular railway on which the engines operate, standard parts being used as much as possible. Superheaters are much used and where track troughs are available, water scoops are provided, so arranged that they may be used when the engine is travelling either funnel or bunker first. So far as yard service is concerned, many lines use eight coupled engines either of the 0-8-0 or 4-8-0 type, the later design having been recently introduced on the North Eastern Railway, but it safely can be said that most of the shunting service is still performed by engines of the 0-6-0 or 0-6-2 type.

There are several different designs of radial axle box in use for supporting the front and rear ends of tank engines. The type used on the London & North Western, Lancashire and Yorkshire and some other lines, is what is known as the Webb pattern. In this design the axle box is made of cast iron and extends across the full width of the engine. The axle boxes are fitted with bearings in the usual way and the connecting piece between the boxes proper is of an inverted U section, wide enough to span the axle. The axle box works in curved pressed steel guides ⅞ in. in thickness bolted to the main framing of the engine. The box is kept central when on a straight track by two right and left hand coiled springs between the main frames under the axle and within the framing of the guides. The movement is limited to 1¼ in. in either direction. The weight on each journal is taken by laminated springs placed above the axle in the usual manner. A pin extends downward from the spring buckle to the top of the axle box; a suitable sliding piece fixed at the end of the pin slides on a flat surface on the top of the box whenever it is deflected in either direction.

Another form of radial box much used consists of two axle boxes made of cast iron of ordinary construction connected together transversely by two steel plates disposed on either side of the axle. The radial motion of the arrangement is obtained by allowing it to swing about a centre pin suitably placed on the longitudinal centre line of the engine to which it is attached by radius rods formed somewhat like a Y, the extremities of the equal legs being attached to each axle box and the single end being suitably formed for working around the center pin. Strong coiled centering springs are mounted on a transverse piece fitted

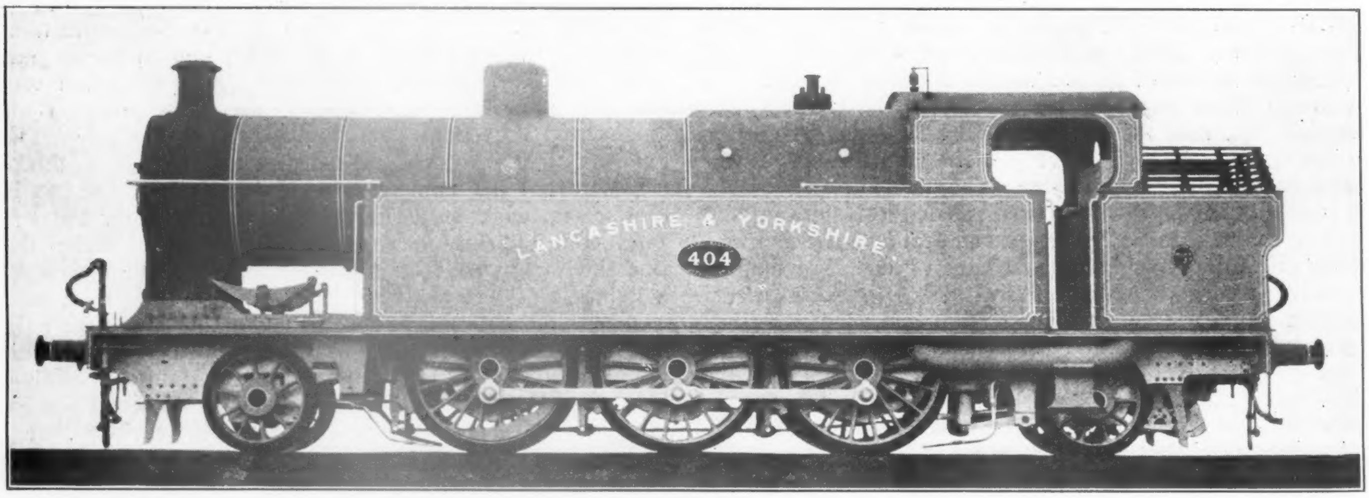
between the main framing of the engine and an attachment on the radial box. The axle boxes do not work in the usual horn blocks as the radius rods hold them in position and there is sufficient play in the radius rod where it is attached to the centre pin to permit of the rise and fall of the axle boxes due to inequalities in the road. The springs are of the laminated type mounted above the boxes and a pin extends from the buckle and bears on a flat plate sliding on the top of each box.

The latest practice on the Great Western, Great Central and Great Northern is similar to American practice in the design of two-wheeled trucks, the radial movement being controlled by radius rods working from a fixed centre and the centering being done by swinging links. Where four-wheeled "bogies" or trucks are used, they are, in general, similar to those used for tender engines. The London & North Western standard bogie provides for a circular turning movement round a centre and for a lateral movement, which takes place between curved guides, the control of which is effected, by means of coiled springs. The most usual form of bogie is arranged so that lateral movement between the truck and the center pin take place in a straight path at right angles to the longitudinal center line of the bogie. The bogie is built up of two side plate frames held by a central casting the upper part of which has a machined surface. This casting is divided transversely by a rectangular cavity which extends nearly the full width between the bogie framing. A casting having its upper surface spherical and machined all over rests on the cross stretcher casting, a suitable rectangular extension on its lower surface fitting into the rectangular cavity in the stretcher casting. Under the inside cylinders is the center casting on which the bogie turns; this center fits into the intermediate casting just described. In the rectangular cavity of the bogie frame stretcher at each side of the rectangular extension on the intermediate casting are disposed coiled compression springs. They hold the bogie central but allow for a limited lateral movement, the turning or circular motion being obtained by means of the center just described. Suitable oil grooves are cut in the working surfaces and lubricators are provided for supplying oil. This bogie is the kind most favored and is known as the Adams bogie. It is a strong construction and results in a steady running bogie. More recently some designers have made use of the American swinging link arrangement for taking care of the lateral motion, but this arrangement is exceptional.



Great Central Passenger Tank Locomotive

Some engineers employ side bolsters for the bogies, this practice being much used on the Great Western Railway. The new "Baltic" type tank locomotives in service on the Brighton Line have side bolsters fitted to the four-wheeled bogies.



Tank Locomotive for Passenger Service, Lancashire & Yorkshire

A number of noteworthy examples of tank engines of modern design are referred to in the table and illustrations. Some of these engines are quite exceptional, particularly the 4-6-4 locomotives for the London, Brighton & South

DIMENSIONS AND PROPORTIONS OF MODERN BRITISH TANK LOCOMOTIVES

Railway	London & No. Western		Great Central		Lancashire & Yorkshire		North Eastern			Great Western			London, Brighton & So. Coast			North British	London and So. Western	Midland
Type	4-4-2	4-6-2	4-6-2	2-6-4	2-4-2	2-6-2	4-4-4	4-8-0	4-6-2	4-4-2	2-6-2	2-8-0	4-4-2	4-6-2	4-6-4	4-4-2	0-4-4	0-6-4
Cylinders, number	2	2	2	2	2	2	3	3	3	2	2	2	2	2	2	2	2	2
Cylinders, size, inches	19 by 26	20 by 26	20 by 26	21 by 26	18 by 26	19 by 26	16½ by 26	18 by 26	18⅛ by 26	18 by 30	18 x 30	18½ by 30	21 by 26	21 by 26	22 by 28	18 by 26	18½ by 26	18½ by 26
Coupled wheels, dia	6' 3"	5' 8½"	5' 7"	5' 1"	5' 8"	5' 8"	5' 9"	4' 7¼"	4' 7¼"	6' 8½"	5' 8"	4' 7½"	6' 7½"	6' 7½"	6' 9"	5' 9"	5' 7"	5' 7"
Steam pressure, lb. per sq. in.	175	175	160	180	160	180	160	175	180	195	195	200	160	170	170	175	150	175
Heating surfaces—																		
Tubes, sq. ft.	1,778	947.4	1,294	1,390	1,108.73	1,877	934	1,169	1,508	907	907	1,228	850	1,398	1,535	1,214	1,067	1,206
Firebox, sq. ft.	161	138.0	141	157	107.68	161	124	141	140	122	122	122	126	125	152	95	123	125
Superheater, sq. ft.	...	248.2	214	304	...	...	273	...	...	185	185	215	305	342	383	...	...	...
Total, sq. ft.	1,939	1,333.6	1,649	1,851	1,216.41	2,038	1,331	1,310	1,648	1,214	1,214	1,565	1,281	1,865	2,070	1,309	1,190	1,331
Total equivalent,* sq. ft.	...	1,457.7	1,756	2,003	...	...	1,467	...	...	1,306	1,306	1,672	1,433	2,036	2,261	...	...	...
Grate area, sq. ft.	22.5	23.9	21	26	18.75	26	23	23	23	20.5	20.5	20.5	24	25.16	26.7	16.6	20.3	21.1
Maximum tractive effort†	17,270	22,400	21,600	29,000	16,800	21,300	20,800	33,800	35,800	19,950	23,600	31,500	19,580	20,800	24,200	17,000	16,600	19,600
Cyl. vol. per mile, cu. ft.	4,510	5,580	5,460	6,920	4,550	4,950	5,690	8,400	8,530	4,360	5,240	6,700	5,280	5,280	6,120	4,490	4,800	4,800
Tanks, water capacity, gal.	1,707	1,700	2,280	3,000	1,540	2,000	2,000	2,500	2,500	2,000	2,000	1,800	2,110	2,300	2,700	1,990	1,300	2,250
Bunker coal capacity, tons	2.5	3.0	4.0	5	...	3.75	4.0	4.25	5.0	3.0	3.0	3.0	3.0	3.0	3.5	4.5	90 cu. ft.	3.5
Weight on coupled axles, lb.	88,480	98,560	120,960	134,400	77,831	118,007	89,600	147,504	124,544	82,880	121,072	156,800	85,120	125,440	126,660	115,360	64,400	119,164
Weight, total in working trim, lb.	167,440	172,480	191,640	212,800	131,377	173,628	189,840	189,616	195,776	168,000	169,120	174,760	163,720	193,040	219,560	154,056	122,416	162,204
Superheating surface as a percentage of the total	...	18.5	13.0	16.4	...	...	20.5	...	...	15.2	15.2	12.8	21.3	18.3	18.5	...	...	....
Cylinder vol. per mile divided by																		
Heating surface, actual	2.33	4.18	3.32	3.74	3.74	2.49	4.26	6.41	5.17	4.15	4.31	4.28	4.13	2.83	2.96	3.41	4.03	3.61
Heating surface, equiv.	...	3.82	3.11	3.45	...	...	3.88	...	...	3.59	4.01	4.00	3.68	2.60	2.70	...	...	...
Grate area	201	233	260	266	242	190.1	246	365	372	334	255	327	221	210	229	270	236	227
Wt. on coupled wheels divided by Tractive effort	5.12	4.30	5.6	7.3	4.6	5.5	4.3	4.3	3.48	4.15	5.13	4.97	4.35	6.03	5.23	6.77	3.88	6.1
Total engine weight divided by																		
Heating surface, actual	86.4	129.3	116.1	114.2	108.0	85.0	142.3	144.0	118.5	138.5	139.0	111.5	127.8	103.4	106.0	118.0	102.0	122.0
Heating surface, equivalent	...	118.5	109.0	105.6	...	...	129.3	...	...	128.8	129.5	104.1	114.0	95.0	97.0	...	...	...
Weight on coupled axles as a percentage of the total engine weight	89.0	57.2	63.3	63.5	58.2	68.0	47.5	72.7	63.7	49.3	71.6	90	52.6	64.7	57.8	74.5	53.0	73.5

* Equivalent heating surface is obtained by adding a value equal to 1.5 times the superheating surface to the total evaporative heating surface.
† Mean pressure assumed to be equal to 85 per cent of the boiler working pressure.

Coast, which have a maximum tractive effort of 24,250 lb. and weigh 220,000 lb. in working trim.

The London & North Western uses two types of tank engines for passenger traffic. The 4-4-2 engines are generally similar to the 4-4-0 express engines in use on the line except that the coupled wheels are 6 ft. 3 in. in diameter instead of 6 ft. 9 in. The cylinders are between the frames and have their valve chests on the top, the two cylinders complete with steam chests being one casting, which is usual practice in British design. Joy valve motion and semi-balanced flat valves are used, and the crank axle is built up and has a central bearing in accordance with Crewe practice. Four coil springs take the weight on each journal of the coupled axles and laminated springs take the weight on the trailing radial axle box and on the bogie wheels. The vacuum brake apparatus is used, the equipment consisting of a large ejector for creating the vacuum and an air pump for maintaining it while the train is in motion. The engines are doing excellent work in the London, Birmingham and in the Manchester districts. The most recent engines introduced have six coupled wheels, a leading bogie and trailing wheels with radial axle boxes at the trailing end under the bunker. These engines have the first Belpair boilers to be applied by the London & North Western and are also fitted with Schmidt superheaters. In general, they are designed in accordance with modern Crewe practice. The fittings include a mechanical lubricator for the valves and pistons taking its motion from one of the cross heads. The back plate of the boiler is covered; this is not usual.

On the Great Central Railway several classes of tank engines are in use and the latest designs represent very powerful engines. The 4-6-2 engines are used for passenger service and the 2-6-4 type are intended for heavy coal traffic, but are fitted with the vacuum brake apparatus and are thus available for passenger traffic if required. The 4-6-2 engine has inside cylinders and 10-in. piston slide valves on the top of the cylinders, which are operated by the ordinary link motion through the medium of rockers. The engine has a Belpair boiler with a 21-element superheater of the Robinson type. The lubricating of the valves and pistons is done by a mechanical lubricator driven from one of the cross heads and having eight feeds. The 2-6-4 engines are fitted with boilers which duplicate with those of the large 4-4-0 express engines known as the "Director" class, and the motion is similar to that used on the large 4-6-0 express goods engines recently described. The cylinders are between the frames and the piston valves are driven through rockers by the ordinary link motion. The connecting rods are milled out to an I section and the big ends are formed by slotting out the end of the rods and fitting in brasses which are held in position by a cap held by two 2¼-in. bolts. A steam brake applies blocks to the coupled wheels and two blocks to each of the wheels of the four-wheeled bogie. The brake on the bogie is applied by two steam cylinders, placed one on each side between the wheels. Each cylinder has two pistons and the brakes are applied by admitting steam between them, a suitable spring arrangement being provided for releasing the brake blocks.

The Lancashire & Yorkshire, besides using the 2-4-2 engines, already mentioned, have in service a number of large 2-6-2 engines, one of which is illustrated. The engines at the time of their introduction were the largest tank engines running in the country. These engines have inside cylinders, with their valve chests above. Semi-balance flat valves are used, driven by the Joy valve motion. The leading coupled axle is the crank axle and is of the built-up type. The leading and trailing ends are carried by radial axles. The water scoop is operated by a vacuum cylinder very like those used for the brake equipment.

Several classes of tank engines are employed on the North Eastern Railway both with two and three cylinders. The

latest type has three cylinders, and particulars of these will be found in the table of dimensions. The passenger engines are of the 4-4-4 type. The three cylinders, together with their valve chests, are cast in one piece. The leading axle is the crank axle and the crank pins are 120 deg. apart. Three sets of link motion, the reversing of which is done by a steam gear, operate the piston valves direct, giving outside admission. The valve for the centre cylinder is on the top with its axis inclined downwards to the centre of the crank axle. The valve chests for the outside cylinders are inside the frames at the side of their respective cylinders. The two four-wheel bogies are alike. Each journal is provided with two coil springs taking the weight through cross beams spanning the axle boxes. The leading springs of the leading bogie and the trailing springs of the rear bogie are made more resilient than the other bogie springs and it is claimed that this arrangement enables the engine to travel over the road more easily. The engines are fitted with the Westinghouse brake equipment which works the brake on the engine as well as the train.

The 4-8-0 engine is for yard work and is similar in the arrangement of its motion to the passenger engines except that the valve for the centre cylinder is driven through a rocking lever, which, as the valves have end admission, necessitates the use of crossed rods. The same arrangement is used on the 4-6-2 engines. In each case the leading coupled axle is the crank axle. For yard work and general service of an intermittent nature three-cylinder engines seem to offer distinct advantages. They are less complicated than four-crank arrangement and the writer favors their more general adoption, either with simple or with compound cylinders.

The 0-6-4 engines used by the Midland were introduced to take the place of 0-4-4 locomotives originally used. They are doing excellent work, especially in the Birmingham and Manchester districts. In the Manchester district they handle trains which load up to 200 tons behind the engine over ruling grades of 1 in 100 to 1 in 130 at 31 miles per hour, including stops. About Birmingham they haul 130-ton trains over grades of 1 in 75 to 1 in 165, at 35 miles per hour,

Three-Cylinder Tank Locomotive for Passenger Service, North Eastern Railway

Great Western 2-6-2 Passenger Tank Locomotive

including stops. The cylinders are between the frames and have flat valves working in chests between the cylinders and operated by the ordinary link gear. A steam brake and steam sanding gear is provided. The wheel splashers and the motion plates are formed from pressed steel, a most unusual practice.

On the Great Western several types of tank engines are in use, the most modern of which are illustrated. The 4-4-2 engine is for passenger traffic, as is also the 2-6-2 engine. These engines follow closely the standard practice of the road in all particulars.* The Belpair boiler with tapered barrel will be noticed, also the cast saddle on which rests the smoke box. The 2-8-0 engines are used for heavy coal and other traffic, and so far as the writer is aware, are the only tank engines of their type in Britain. The coupled wheel base is 20 ft. and in order to ease the locomotive when passing around curves, the trailing wheels are allowed one inch side play on each side of the engine. The knuckle joints in the coupling rods are fitted with spherical bearings.

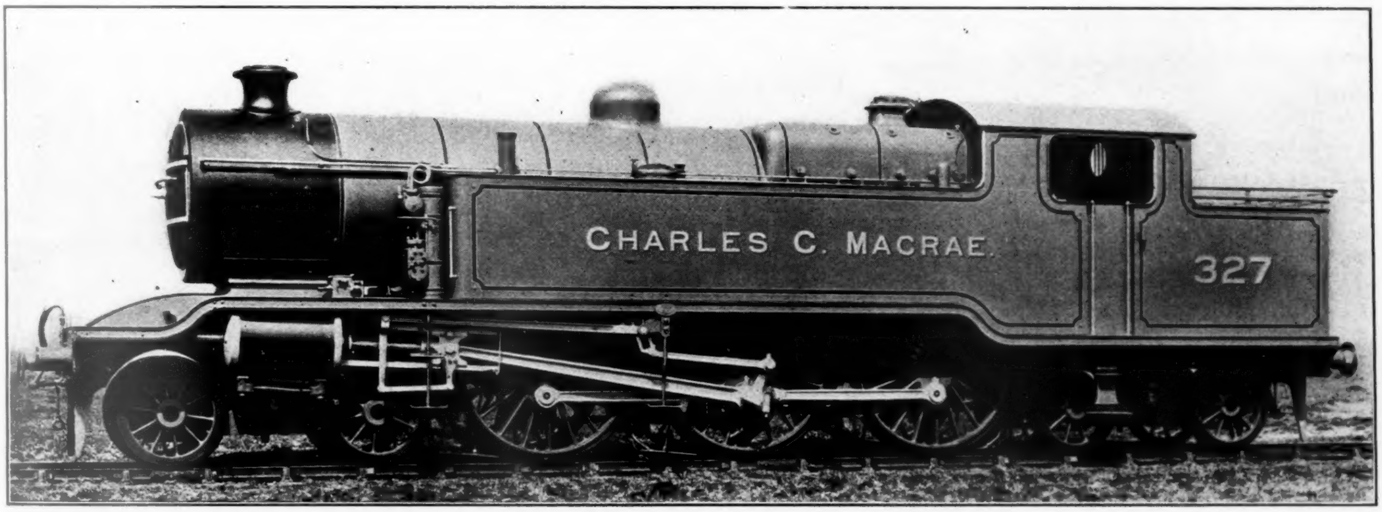
The greatest development in tank locomotive design has, undoubtedly, taken place on the London, Brighton & South Coast and recent engines are enumerated in the table in the order of their appearance. The 4-4-2 engines were introducd some years ago and showed that still larger engines might be utilized with the result that the 4-6-2 type appeared. This differs mainly in the location of the cylinders which were inside in the 4-4-2 engine and outside in the 4-6-2 design; both have Schmidt superheaters, piston valves and link motion. The 4-6-2 engines have now been followed by 4-6-4 engines, which are the largest engines of their kind in Britain.

The present engines have been built at Brighton by L. Billington for working express trains between London and Brighton and London and Portsmouth. The boilers have Belpair fire boxes and Schmidt superheaters of 21 elements. The cylinders are outside and drive on to the second coupled axle. Walschaert valve motion is used, working piston valves in valve chests between the frames. The motion is transferred by means of rocking shafts having a short lever at each end and on the same side of the centre line. The feed water in the tanks is heated by part of the exhaust steam. A Wier feed pump is placed on the left-hand side of the engine in front of the side tank, and a hot water Gresham & Craven injector is mounted on the fire box back plate. Two coil springs to each axle box take the weight on the coupled axles and two coil springs to each axle box take the weight on the bogie wheels through the medium of cross beams spanning the axle boxes. Both the front and rear bogies are identical.

The cylinders are fitted with a special design of automatic by-pass and air valves. The device consists of two small cylindrical castings, one placed inside and concentric with the other. The inner chamber is fitted with a small piston, the upper side of which bears against the rounded end of the stem of a small disc valve which seats on a port in the main cylinder barrel. The under side of the piston is connected by a small pipe to the main steam chests. The outer castings of the two valves required for each cylinder are connected by a suitable pipe and at the bottom of the outer casting is fitted a small disc valve which opens inward and is supported by a light coil spring. On steam being admitted to the main steam chests, the small pistons hold the relief valves to their seats. When, however, steam is shut off, these valves fall and thus establish connection between the two ends of the cylinder. Should there be a tendency to form a vacuum, the valve at the bottom of the outer casing allows air to enter freely.

The reversing of the engine is effected by a screw and wheel gear. The screw passes through a cylinder supported on trunnions and containing a piston and hollow piston rod engaging with the main screw. Air from the Westinghouse brake system is admitted to the front side of this piston, so that in moving it forward to raise the connecting links, the driver is assisted by the air pressure. The gear is held in the required position by a clamp on the reversing shaft, also operated by air pressure. A small handle working a three-way cock is mounted in a convenient position near the reversing wheel for controlling the air supply to the reversing cylinder or to the clamping cylinder, as desired. In its central position the cock puts both these cylinders in communication with the atmosphere, in the second position air is admitted to the clamping cylinder to hold the gear and in the third position air is exhausted from the clamp cylinder, thus freeing the gear and at the same time air is admitted to the reversing cylinder to assist in raising the links.

The North British and the London & South Western engines, referred to in the table, are not large engines. They are, however, in point of power, representative of many tank locomotives running on other lines. The London & South Western engine has inside cylinders with valves and motion similar to the North British engine. It has, however, a built-up crank axle, having the crank webs extended to form balance weights and no balance weights are placed in the wheel centres. This engine is fitted with a feed water



Tank Locomotive for Express Passenger Service, London, Brighton & South Coast

* For more details of Great Western practice, see the *Railway Mechanical Engineer* for November, 1916, page 552, and December, 1916, page 621.

heating arrangement consisting of a number of tubes placed in the side tanks through which is conveyed part of the exhaust steam, the water thus heated is delivered by a duplex steam pump placed under the running board between the trailing coupled axle and the leading bogie wheels. The pump is direct acting, and has two steam cylinders 4½ in. by 8½ in. and two water cylinders each 3½ in. by 8½ in. The heating surface in the tanks is 234 sq. ft. No injectors are used. It may be mentioned that the subject of feed water heating has received considerable attention in Britain and exhaust steam injectors designed to handle hot water are being used to a considerable extent on many railways with good results. The engine has a steam reversing gear consisting of steam and water cylinders, the latter being used to hold the gear.

The table of dimensions is self explanatory, and a study of it will bring out the characteristic features of British tank locomotive proportions. It will be noticed that in most cases cylinders are much larger in proportion to boiler heating surface than is usual practice with tender engines. This is due to the fact that high power is not required to be developed for long periods of time with engines of this type; it is also due in part to the fact that boiler weight has to be kept down owing to the water tanks being carried on the engine framing. The factor of adhesion is also higher in engines of this type than is usual with tender engines. This feature is of value when making rapid starts, which are necessary in local passenger service and in shunting operations.

The photographs from which the illustrations have been prepared are all by Mr. F. Moore, Finsbury Circus, London, E. C.

CAR AND LOCOMOTIVE PRICES

Figures given by the Interstate Commerce Commission in the appendix to its decision in the Fifteen Per Cent case show increases of from 50 to 150 per cent in the prices of cars and locomotives in 12 months' time. Furthermore, prices have increased about 30 per cent since the first of the year and are still on the upward trend.

A year or two ago a freight car cost about $1,000 to $1,500. The Pennsylvania in February paid $3,742 for a 70-ton hopper car and $3,555 for an all-steel box car. The Pennsylvania, according to President Rea, wanted to buy 5,000 coal cars. At $3,742 each the road's reasons for omitting to provide itself with this equipment are apparent.

The railroads of this country up to about the first of June were buying locomotives on a large scale, 1,933 engines in the first five months of 1917 as compared with 1,563 in the same period of 1916. They had to pay as high as $60,000 for Mikado or Santa Fe locomotives, $35,000 for eight-wheel switching locomotives and $25,000 for six-wheel switching locomotives. The Norfolk & Western had a chance in May to buy some big Mallet locomotives; but the price asked was too much. The road is now building the locomotives in its own shops. Two other roads are reported to have paid over $100,000 for Mallet locomotives. The table shows concrete examples of the increase in prices.

CAR AND LOCOMOTIVE PRICES THIS YEAR AND LAST

CARS—

Road	Type	1916 Price	1916 Date of Order	1917 Price	1917 Date of Order
Chesapeake & Ohio	Hopper	$949	....	$1,531	October, 1916
Chicago, Burlington & Quincy	Box	808	Feb. or July, 1915	1,540	November, 1916
	Gondola	1,637	March, 1915	1,891	November, 1916
Illinois Central		1,682	....	2,600	....
Northern Pacific	Refrigerator	1,559	(1913)	2,475	January, 1917
	Gondola	1,042	(1913)	2,175	January, 1917
		Last lots purchased in 1913			
Pennsylvania Lines East	Steel coal	1,466	January, 1916	3,742	February, 1917
	Steel box	1,500	January, 1916	3,555	February, 1917
Southern Pacific	Tank	1,468	March, 1916	2,807	February, 1917
	Gondola	1,295	February, 1916	1,919	February, 1917
	Combination baggage and mail	9,786	February, 1916	12,319	March, 1917
Western Maryland	Coal	1,035	October, 1915	1,529	October, 1916

LOCOMOTIVES—

Road	Type	Weight	1916 Price	1916 Date of Order	1917 Price	1917 Date of Order
Chesapeake & Ohio	2-6-6-2	435,000	$31,019	October, 1915	$48,139	June, 1916
Chicago, Burlington & Quincy	Santa Fe	367,850	26,518	March, 1915	46,450	November, 1916
	Mikado	....	22,017	March, 1915	42,505	November, 1916
Chicago, Indianapolis & Louisville	Santa Fe	350,000	31,300	March, 1916	59,000	....
Delaware & Hudson		Price of a locomotive 25 per cent larger than former ones is 200 per cent higher.				
Illinois Central	Mikado	278,000	22,205	February, 1915	41,661	February, 1917
	6-wheel switching	170,000	12,400	January, 1915	26,756	February, 1917
	Pacific	278,000	27,818	February, 1916	42,935	February, 1917
New York, Chicago & St. Louis	Switching	173,500	19,250	March, 1916	23,375	November, 1916
		1917 locomotives bought under option given November, 1916. If bought in open market would have cost $31,750.				
Norfolk & Western		....	43,360	....	77,500	....
		Quotation not accepted and none bought.				
Northern Pacific	Mallet	456,000	42,025	(1913)	61,200	January, 1917
	Mikado	320,000	27,977	(1913)	42,700	January, 1917
	Mikado	320,000	.....	....	61,950	April, 1917
Pennsylvania Lines East	Mikado	....	39,000	Jan. or May, 1916	63,000	February, 1917
Pere Marquette	Santa Fe	320,000	Not shown	....	56,250	April, 1917
	8-wheel switching	204,000	Not shown	....	38,900	April, 1917
Southern Railway	Santa Fe	370,000	$38,400	April, 1916	73,850	May, 1917
	8-wheel switching	....	25,483	....	35,850	May, 1917
Toledo, St. Louis & Western	Consolidation	193,000	19,453	December, 1915	24,316	....
Union Pacific	6-wheel switching	156,000	14,913	January, 1916	26,780	March, 1917
Western Maryland	2-8-8-2	495,000	37,276	June, 1915	66,531	October, 1916

NOTE—The figures in the foregoing table were compiled as follows: The name of the road, the prices given and the type of locomotive or car are given in appendices 3 and 5 of the Interstate Commerce Commission's report in the Fifteen Per Cent Case. The dates of the orders, the weights of the locomotives, etc., have been supplied from the records of the Railway Age Gazette.

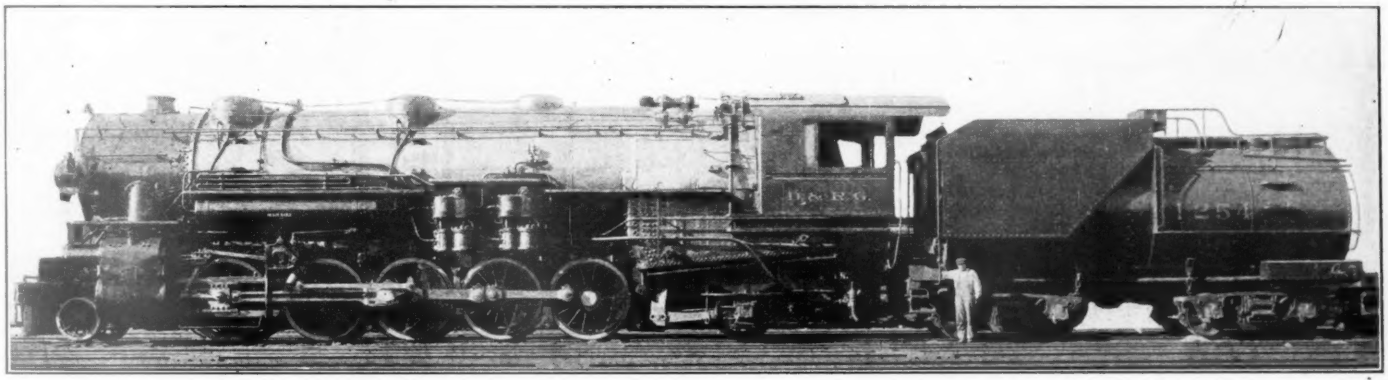
SHORTAGE OF SHIPPING IN AUSTRALIA.—During the year ending June 30, 1916, there was a falling off of 83,000 tons of freight on the railways of Western Australia, owing to one million bags of wheat having had to remain stacked in the country districts, owing to the scarcity of shipping.

D. & R. G. SANTA FE TYPE LOCOMOTIVES

Heaviest Non-Articulated Locomotives Ever Built; a New Design of an Automatic Drifting Valve is Used

About six months ago the Denver & Rio Grande received from the American Locomotive Company ten locomotives of the 2-10-2 type which weigh 428,500 lb. and have a tractive effort of 81,200 lb. Of these, five are being used between Denver and Salida, Col., on through freight trains and five are being used between Minturn and Tennessee Pass, Col., which is at the top of the grade between Minturn and Malta, as helpers. There are many heavy grades and sharp curves. On the line between Denver and Salida the maximum grade is 1.42 per cent with 6-deg. curves, not compensated, and at one point there is a 12-deg. 30-min. curve. Between Minturn and Tennessee Pass the maximum grade is 3 per cent and the westbound track has a maximum curvature of 16-deg. Since the rigid wheel base of these locomotives is only 16 ft. 6 in., no difficulty is experienced in operating on these sharp curves. These locomotives were not designed for helper service, the Mallet type being regularly used for that purpose. Owing to the demands of traffic it was found necessary to use a larger number of helper locomotives and the 2-10-2 type was chosen as best fitted for the work.

In the district between Denver and Salida the traffic amounts to approximately 80,000,000 ton-miles per month. About 25 locomotives are required to handle this tonnage. In January, 1917, when the consolidation type was being used, the gross tons of freight per locomotive-mile in this district averaged 942. In March, with five of the 2-10-2 type locomotives in service, the average tonnage was 1,068, an increase of 13.4 per cent. While the traffic increased 1.2 per cent as compared with January, 1917, the train-miles decreased 7 per cent and the locomotive-miles decreased 11 per cent.



The Heaviest Non-Articulated Locomotive in the World—Denver & Rio Grande

A tabular comparison of these locomotives with the Consolidation and Mallet types, which are used in the same district, is given below:

Type Service	2-10-2 Through Freight and Helper	2-8-0 Through Freight	2-8-8-2 Helper
Tractive effort	81,200 lb.	44,000 lb.	95,000 lb.
Weight in working order	428,500 lb.	220,400 lb.	458,000 lb.
Weight on drivers	337,500 lb.	194,100 lb.	394,000 lb.
Weight of engine and tender	624,900 lb.	378,100 lb.	629,200 lb.
Wheel base, driving	22 ft. 6 in.	15 ft. 8 in.	40 ft. 8½ in.
Wheel base, rigid	16 ft. 6 in.	15 ft. 8 in.	15 ft. 0 in.
Wheel base, engine and tender	76 ft. 9½ in.	59 ft. 5¼ in.	91 ft. 3¼ in.
Cylinders	31 in. by 32 in.	23 in. by 28 in.	26 in. and 40 in. by 32 in.
Driving wheel diameter	63 in.	57 in.	57 in.
Boiler, working pressure	195 lb. per sq. in.	200 lb. per sq. in.	200 lb. per sq. in.
Heating surface, total	5,369 sq. ft.	3,036 sq. ft.	5,125 sq. ft.
Superheater heating surface	1,329 sq. ft.	....	998 sq. ft.
Equivalent heating surface	7,362 sq. ft.	3,036 sq. ft.	6,622 sq. ft.
Grate area	88 sq. ft.	49 sq. ft.	80 sq. ft.

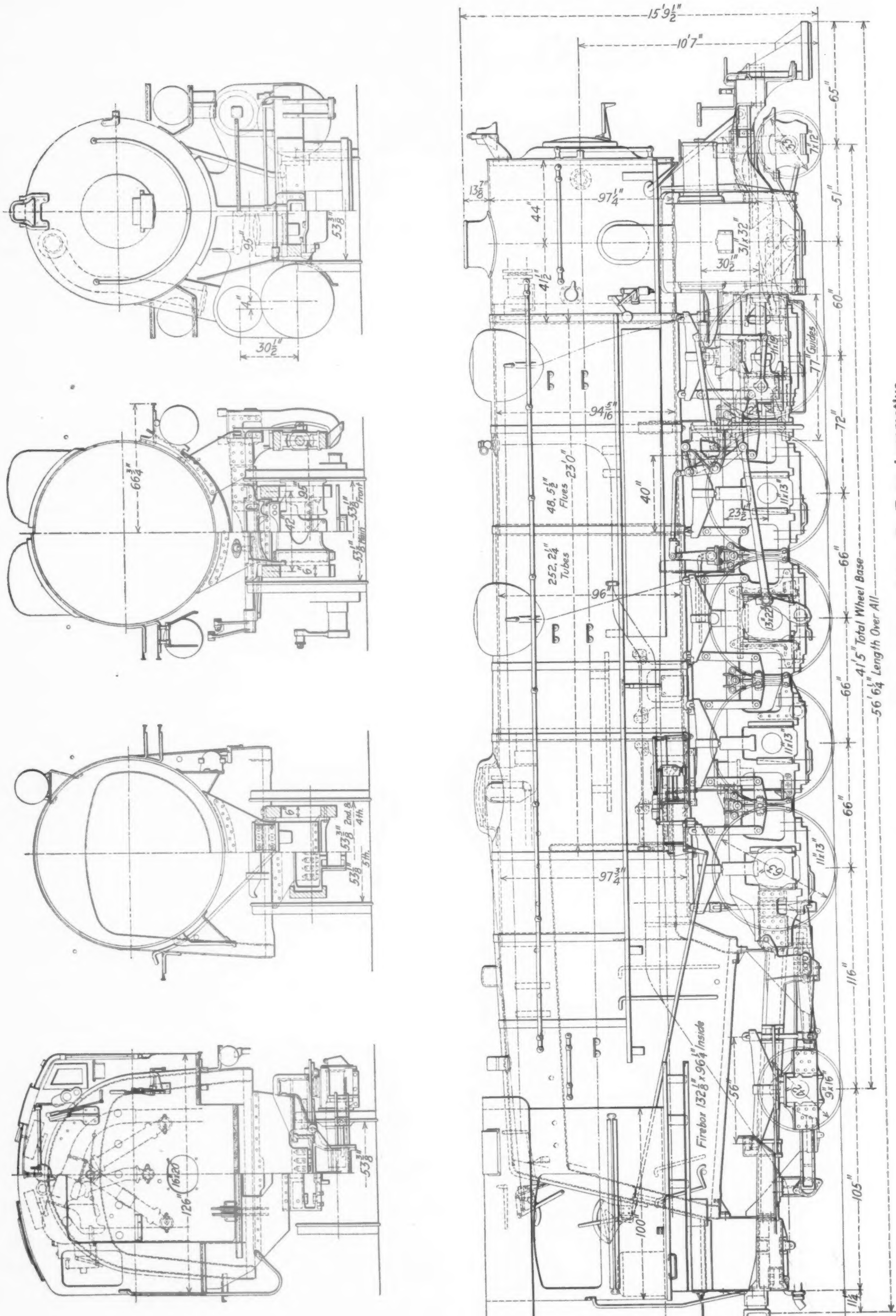
In order to make it possible for these locomotives to take 16-deg. curves without trouble, the tires on the first, the main and the last pairs of drivers were set 53⅛ in. apart. On the second and fourth pairs, the tires are set 53⅜ in. apart. Lateral flexibility in the driving wheel base is secured by the use of the Woodward floating front driving axle. The front truck has 6½-in. swing either side of the center and the trailing truck 4¾ in.

The boiler has been carefully designed to secure high capacity. It is of the conical type, being 96 in. in diameter at the first ring. An auxiliary dome is provided to carry the safety valves and the whistle. The firebox is fitted with a combustion chamber 50 in. long and has a Security brick arch. The locomotives have Schmidt superheaters and are fired by Street stokers. There are two blow-off cocks on each side of the firebox and one is placed in the front course of the boiler.

The frames are of cast steel, with a top rail 6 in. by 7 in. increasing to 6 in. by 9 in. over the driving boxes. The front frame rails are 6 in. by 13 in. The Commonwealth locomotive cradle is used. They have bushings of Hunt-Spiller gun iron, and the pistons are fitted with bull rings of the same material. The piston valves are 16 in. in diameter.

A new device which has been applied to these locomotives is the Vincent drifting valve. This consists of a valve attached on the end of the main valve stem and working in a chamber extending out from the valve head. This chamber is connected to the boiler through an automatic shut-off valve. It is connected to the steam pipe through a check valve.

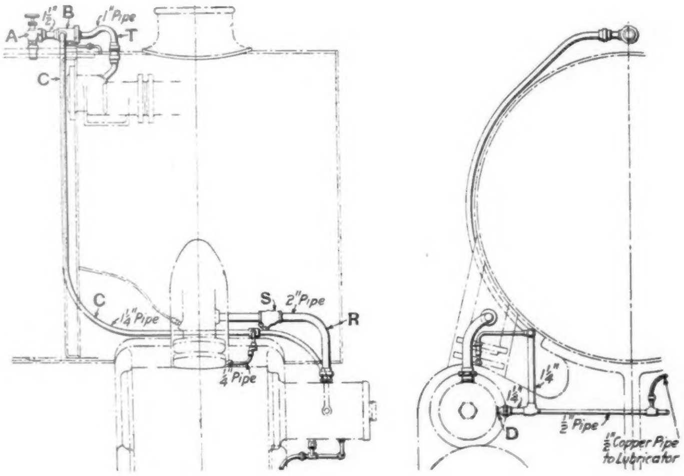
The operation of the drifting valve is as follows: When the main throttle is opened, superheated steam from the header passes through the pipe shown in the drawing at *T* to the differential valve *B* and closes it against the boiler pressure. When the main throttle is closed, saturated steam from the boiler is admitted through the valve *A* to the differential valve *B*, and thence through a 1¼-in. pipe *C* to the drifting valve connection *D* or *E*. It then passes into chamber *F*, through ports *G* into chamber *H*, and through ports *K* into chamber *L* or *M* according to the position of the valve *J*. When the position of the valve *J* is reversed, steam exhausts through the ports *K* and *N*, or *P*, into the chamber *Q*, and thence through the pipe *R* into the main steam pipe and steam chest. A check valve *S* prevents steam from



Elevation and Sections of the Denver & Rio Grande Santa Fe Type Locomotive

the main steam pipe entering the pipe *R*. Drain pipes are provided at the bottom of the chambers *L* and *M*.

The tires on all wheels of these locomotives are flanged. The axles are of carbon vanadium steel, the main axle having bearings 13 in. in diameter and 22 in. long, while the front bearings are 11 in. by 19 in. and all others 11 in. by 13 in. The main crank pins have 9½-in. by 10-in. bearings for the main rods and 10½-in. by 5½-in. bearings for

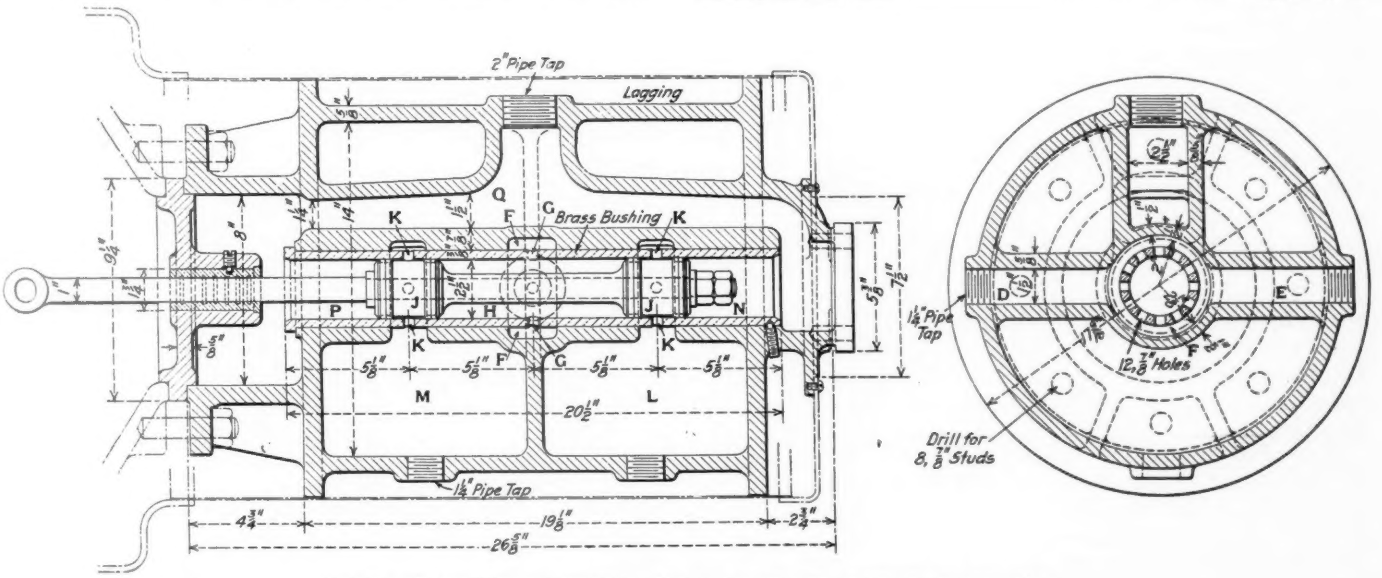


Arrangement of Piping, Vincent Drifting Valve

the side rods. The crank pins, side rods and piston rods are of Nikrome steel. The valve motion is of the Baker type controlled by the American Locomotive Company's power reversing gear.

The brake equipment is the Westinghouse E T, with two 8½-in. air compressors. Two 14-in. by 12-in. brake cylinders attached to the frames behind the cylinders are provided for the first three pairs of drivers. The fulcrums for these cylinders are attached to the frames beneath the cylinder saddles. The two rear pairs of drivers are braked by two 12-in. by 10-in. cylinders. The tender trucks are provided with clasp brakes.

Among the specialties applied to these locomotives are the Chambers throttle, Nathan non-lifting injectors, Woodward engine trucks, Cole trailing truck, Chicago flange lubricator and Economy radial buffer. The tenders are equipped with Miner friction draft gear, Barber side bearings and lateral rollers, the Lindstrom syphon tank valves and Davis cast steel wheels.



Details of the Vincent Drifting Valve for the D. & R. G. Locomotives

The principal dimensions and ratios of these locomotives are as follows:

General Data

Gage	4 ft. 8½ in.
Service	Freight
Fuel	Bit. coal
Tractive effort	81,200 lb.
Weight in working order	428,500 lb.
Weight on drivers	337,500 lb.
Weight on leading truck	31,000 lb.
Weight on trailing truck	60,000 lb.
Weight of engine and tender in working order	624,900 lb.
Wheel base, driving	22 ft. 6 in.
Wheel base, total	41 ft. 5 in.
Wheel base, engine and tender	76 ft. 9½ in.

Ratios

Weight on drivers ÷ tractive effort	4.16
Total weight ÷ tractive effort	5.28
Tractive effort × diam. drivers ÷ equivalent heating surface*	694.9
Equivalent heating surface* ÷ grate area	83.66
Firebox heating surface ÷ equivalent heating surface,* per cent	5.00
Weight on drivers ÷ equivalent heating surface*	45.84
Total weight ÷ equivalent heating surface*	58.20
Volume both cylinders	27.95 cu. ft.
Equivalent heating surface* ÷ vol. cylinders	263.4
Grate area ÷ vol. cylinders	3.15

Cylinders

Kind	Simple
Diameter and stroke	31 in. by 32 in.

Valves

Kind	Piston
Diameter	16 in.
Greatest travel	6¾ in.
Outside lap	1 in.
Inside clearance	0 in.
Lead in full gear	3/16 in.

Wheels

Driving, diameter over tires	63 in.
Driving, thickness of tires	3½ in.
Driving journals, main, diameter and length	13 in. by 22 in.
Driving journals, front, diameter and length	11 in. by 19 in.
Driving journals, others, diameter and length	11 in. by 13 in.
Engine truck wheels, diameter	33 in.
Engine truck, journals	7 in. by 12 in.
Trailing truck wheels, diameter	42 in.
Trailing truck, journals	9 in. by 16 in.

Boiler

Style	Conical
Working pressure	195 lb. per sq. in.
Outside diameter of first ring	96 in.
Firebox, length and width	132 in. by 96¼ in.
Firebox, water space	Front, 7 in.; sides and back, 6 in.
Tubes, number and outside diameter	252—2¼ in.
Flues, number and outside diameter	48—5½ in.
Tubes and flues, length	23 ft. 0 in.
Heating surface, tubes and flues	5,001 sq. ft.
Heating surface, firebox	368 sq. ft.†‡
Heating surface, total	6,369 sq. ft.
Superheater heating surface	1,329 sq. ft.
Equivalent heating surface*	7,362 sq. ft.
Grate area	88 sq. ft.

Tender

Tank	Vanderbilt
Frame	Cast steel
Weight	196,400 lb.
Wheels, diameter	33 in.
Journals, diameter and length	6 in. by 11 in.
Water capacity	10,000 gal.
Coal capacity	21 tons

* Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.
† Includes arch tube heating surface.
‡ Includes combustion chamber heating surface.

Rock Island Fuel Department

Reports to Chief Operating Officer; Controls the Purchase, Distribution and Consumption of All Fuel

THE fuel department of the Chicago, Rock Island & Pacific is unique in that the purchase of the fuel, its distribution, method of handling, and its consumption are in the hands of the mining and fuel department, the manager of which reports direct to the chief operating officer of the road. This brings under one head all questions pertaining to fuel and presents an opportunity for the obtaining of a true fuel economy, cost and consumption considered.

ORGANIZATION

The officers of this department rank as general officers and deal directly with the superintendents of the various divisions. Each superintendent is held responsible to this department for the proper handling and use of fuel. The manager of this department has the following assistants:

1. General superintendents of mines, who look after the operation of the company's coal mines.
2. A superintendent of fuel, who looks after the purchase of fuel, its distribution and handling.
3. A superintendent of feel economy, who looks after the fuel economy work.

This article deals more particularly with the fuel purchased and no reference to the mining organization is therefore made.

To the superintendent of fuel report five inspectors who look after the preparation of coal and oil, and weights thereof; and the coal chute supervisor and his two inspectors, who look after the handling of coal at fuel stations.

To the superintendent of fuel economy report the engineer of fuel economy, who has a staff of six assistant engineers, and the inspector of stationary boiler plants.

Instructions regarding the use of fuel in locomotive service and at stationary plants emanate from the office of the mining and fuel department. They are sent to the division superintendents for distribution to the assistant engineers of fuel economy, the road foremen of equipment, stationary plant engineers, or whoever is affected by them. All questions which arise on the road concerning fuel are submitted through the various division superintendents to the Mining and Fuel Department.

The duties of the superintendent of fuel are the negotiation of contracts and the purchase of fuel, including coal for locomotives and stationary plants, coke, and oil, and such other special fuels as may be required. His staff looks after the inspection of the fuel, the checkweighing of cars, including surprise checkweighing tests to eliminate carelessness, deliberate or otherwise, one the part of the mine weighmaster.

The fuel inspectors advise the main office regularly as to labor matters and any unusual conditions existing at the mines which may in any way interfere with the prompt delivery of coal. Fuel inspectors also send in samples of coal from the various mines for laboratory test, so that from the information available the most suitable coals can always be selected for the respective requirements.

The duties of the coal chute supervisor are to look after the cost of handling fuel and the operations of the 157 chutes on the system. With his two inspectors he sees that the fuel is handled at the lowest possible cost, and where necessary he recommends changes which will reduce the cost, co-operating with the superintendents on their respective divisions.

The duties of the superintendent of fuel economy and his six assistants are to look after the economical use of fuel on locomotives, which consists in the instruction of the engine crews in the best method of firing and the supervision of the condition of locomotives as far as they affect the consumption of fuel. This includes the inspection of engines at terminals to the extent that the boilers are properly cleaned inside and outside; that the required size of nozzle is maintained; that all packings are in a condition for best operation.

The fuel economy staff also holds general meetings at the larger centers, where by moving pictures and lantern slides the essential features of fuel economy are vividly brought to the attention of the men using the coal. These instructions include the prevention of obnoxious smoke and other features which are essential to the best results.

The duties of the supervisor of stationary plants are to look after the fuel consumption of the stationary plants and to generally supervise the steam generating plants used for the operation of shops, pumps and for heating. He sees that the boilers are fired in the proper manner and that boilers, steam and air pipes are maintained to prevent leaks which cause an increase in fuel consumption.

The entire staff co-operates in any method which may bring about the most economical results, and while certain assignments of duties are made, there is a general interchange of work on matters which bring about final results; in traveling over the system every employee is required constantly to keep fuel economy before him. The coal inspectors traveling from one mine to the other are required to travel on locomotives in order to note that tanks are not overloaded at fuel stations, which is the particular duty of the coal chute inspectors; in like manner the coal chute supervisors at terminals check the movement of coal cars, loaded and empty.

DISTRIBUTION

The Rock Island uses coal from approximately 70 coal mines. The most economical grade of coal is determined for each point on the system and daily schedules of delivery are drawn up each week in the general office, and the amount of coal to be delivered during the coming week is determined from the previous week's consumption. A coal report is made up in the office of each superintendent daily, the day ending at 6 p. m.; this is wired to the general office before 3 a. m. the next morning. The information conveyed in this report is as follows: Amount of coal in pockets at the coaling stations and on the chutes in cars; number of cars not placed at the chutes; amount of coal used at each station during the preceding 24 hours; number of cars in transit for this and other divisions and to what stations consigned; number of loaded cars with company coal waiting for train, including the stations at which the cars are held and to what station they are consigned; amount of coal received from each individual mine and from junction points; amount of company coal in cars billed from the mines and junction points and to what stations it is consigned; number of cars of company coal loaded at the local mines; number of empty cars delivered to the local mines for company coal; number of cars of company coal received from local junction points with other roads and the number of empty cars delivered to those points; amount of storage coal loaded or unloaded; together with the amount on the ground at the various stations; amount of fuel oil on hand in storage tanks and in cars, and the number in transit at each station. Also the number of gallons of fuel oil consumed during the preceding 24 hours.

This report gives the general office complete information regarding the amount of coal on hand at each station, shows the location of the cars in transit to other divisions and shows whether or not the mines are keeping up with their daily schedule of output.

Under normal conditions, about 1000 cars are required to keep the stations supplied, and this represents about 4½ days' consumption for the system. In addition to this, about one day's supply is kept in the various chutes and fuel station bins. Particular attention is given to the proper utilization of cars, and box cars are frequently used even though the cost of handling is greater, to effect greater car efficiency. Self-cleaning cars are assigned to chutes equipped for mechanical handling, other cars were unloaded by hand.

Special efforts are made to prevent the mixing of coal and to furnish regularly the same grades of coal for use on a given territory.

LOCOMOTIVE PERFORMANCE

To this time no attempt has been made to check the individual performance of each engine crew, but collective statements showing the performance on each division, divided into freight, passenger and switch service are posted in the round houses which show the performance of each division compared with the same month of previous year and the loss or gain reduced to dollars and cents and the respective position which each division occupies toward the entire system. These statements are furnished in the shape of graphic charts and in tabulated figures as well. The engine crews are fully informed that these tables do not reflect conditions entirely within the control of the management. There are certain factors, such as the quality of coal available, type and size of engine used, grade conditions, and density, direction and distribution of traffic, which all have an important bearing on coal consumption, but inasmuch as some of these conditions are more or less permanent, any change of conditions is readily observed by the up or down grade lines on the graphic charts, and considerable competition has been developed in this direction.

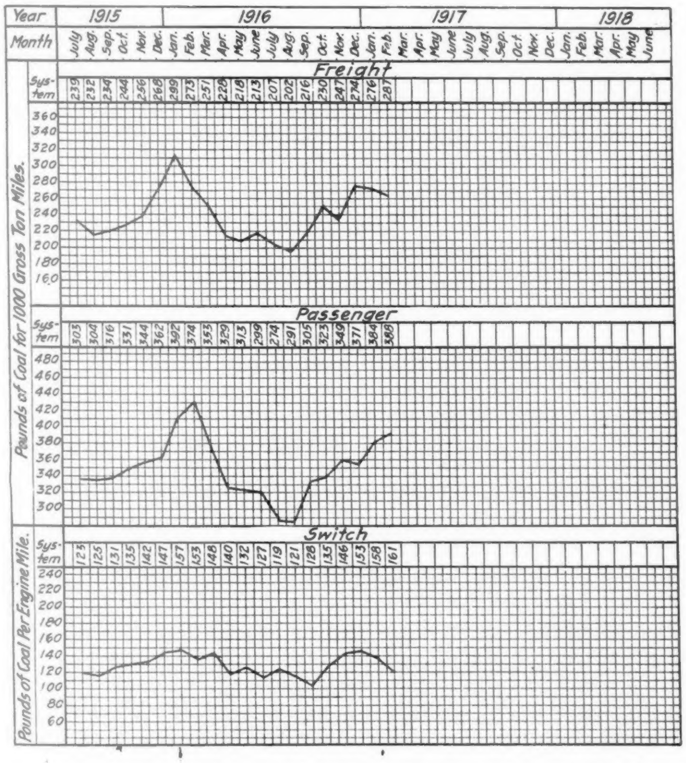


Chart Showing the Fuel Performance of an Individual Division

It is contemplated in the very near future to adopt an individual performance record, which will be prepared in the office of each division superintendent immediately at the end of each run. The information as to the consumption of coal will be obtained from a slip made out by the engineers showing the amount of coal used on each trip. This fuel consumption slip is a part of the time check and will be handed in at the superintendent's office with the time slip so that the information will be promptly available and enable the immediate compilation of the performance of each engine. This method will obviate the necessity for coal tickets which are now used but from which no satisfactory reports can be compiled.

RESULTS

This organization has been in operation for about a year, and while this period is entirely too short to determine the full possibilities, it may nevertheless be of interest to point to the following comparisons:

For the year ended June 30, 1915, the amount expended for coal for all uses amounted to $7,168,378.41, and for the year ended June 30, 1916, the corresponding amount was $6,762,430.88, or a difference of $405,947.53. This saving was made with an increase in 1000 ton-miles in freight service of 913,866. This indicates a saving of $826,802.56. In other words, had as much work been done in 1915 as was done in 1916, the fuel bill for 1915 would have been 12.2 per cent greater than it was during the year 1916. It is safe to anticipate that the increased cost of coal due to higher wages calls for intensified work in the direction of fuel economy and that the use of improved mechanical appliances and better firing methods will result in a decided reduction in the quantities consumed, a situation most necessary in view of the rapidly climbing cost of coal.

METHOD OF INCREASING AIR CAPACITY ON DOUBLE HEADED TRAINS

BY E. F. GIVIN
Mechanical Engineer, Pittsburg, Shawmut & Northern

Double heading freight trains has made great reductions in the cost of operation per ton-mile, but at the same time has produced annoying delays, pump failures and breaks-in-two that in many cases can be traced directly to a too small air compressing plant in connection with the desire of the engineman to get over the road in the required time. With the increase in the number of cars in a train, is a corresponding increase in the train line leakage, a large percentage of which cannot be stopped by the train crew. Inasmuch as it is impracticable for both engineers on the locomotives to operate their brakes simultaneously, the air compressing plant of the leading locomotive must take care of the train, including the leakage, as best it can, while the compressing plant of the second locomotive is idle.

On the Pittsburg, Shawmut & Northern the large freight locomotives are equipped with either one No. 5 or two No. 6 New York air compressors, the main reservoirs havifig a capacity of from 50,000 to 70,000 cu. in. Theoretically this is sufficient to take care of an 80-car train and when on account of the extreme traffic conditions, it was attempted to double head trains, no excessive trouble was anticipated. It soon developed, however, that the capacity of the leading locomotive was not sufficient to produce the proper results and a prolonged car shortage has exaggerated these troubles. It became necessary to devise some means to allay, at least, part of the difficulty. To get the trains out of the yards at terminals it was necessary for the second locomotive to be cut in to assist in charging the train, but this led to various abuses by some venturesome engineers which were dangerous, and it was necessary to abandon the practice.

This made it necessary to either apply more air compressors and reservoirs to the locomotives or to devise some

means by which the capacity of the second locomotive could be utilized. The plan developed was the application of a main reservoir line to each locomotive by which the pumps and main reservoirs of each locomotive could be coupled together, thus increasing the capacity directly in proportion to the number of locomotives coupled. Increasing the pump and main reservoir capacity was not feasible because:

First.—The first cost was prohibitive when considering that the main reservoir line could be applied to each locomotive for about $25.

Second.—The design of the locomotives would not permit increasing the air producing plant and storage without seriously interfering with other apparatus and materially discommoding the making of running repairs to the locomotive.

Third.—To apply a second No. 5 pump to the locomotives having only one No. 5 pump would immediately produce trouble as the enginemen would show a preference for these locomotives.

Fourth.—As none of the freight locomotives have superheaters it appears to be inviting steam failures to increase the steam consumption by applying another pump, especially on locomotives that were not free steamers.

Fifth.—The air compressing plant on the second locomotive would still be idle.

The application of a main reservoir line appeared to present one very serious difficulty—the loosing of the main reservoir pressure should a hose burst. But investigation shows that this is more of a prejudice than an actual danger, as many passenger trains are operating with a 110 lb. train line pressure with the M. C. B. standard air hose between the cars. The M. C. B. standard air hose specifications require a 500 lb. hydraulic test pressure for a certain length of time without developing leaks or defects which convinced us that there was little likelihood of a failure from this source, although it was guarded against in the instructions as shown further on. As a matter of information we use the New York B3 HP locomotive equipment with the independent straight air valve and carry 90 or 110 lb. main reservoir pressure. The source of loosing the main reservoir pressure due to breaking off a pipe has always been present on a locomotive and has frequently occurred without any serious results, especially on locomotives with large pumps and main reservoir capacity.

The advantageous features developing from the use of the main reservoir line are as follows:

First.—Increasing the pump and main reservoir capacity in proportion to the number of locomotives added to the head end of the train.

Second.—It cut the time of charging trains at terminals or on the road in the same proportion.

Third.—It decreases the tendency of the brakes to drag and practically prevents breaks-in-two from the brakes not releasing promptly on the rear end.

Fourth.—It divides the service of the compressors cutting down the chances for compressor failures and decreases the wear and tear on the compressors.

Fifth.—It equalizes the steam consumption of the compressors tending to help a poor steaming locomotive.

Sixth.—Should the compressor fail on the leading locomotive it prevents having to change the second locomotive to the lead. The lead engineman has the use of the compressors on the second and any other locomotives coupled in on the head end of the train just the same as though they were on his own locomotive.

Seventh.—It gives the engineman much more confidence in his ability to handle the train successfully and increases his efficiency accordingly.

The method of piping followed in using this main reservoir line is shown in the illustration, a 1¼-in. pipe being used. These lines are tapped into the main reservoir and extend to the forward end of the locomotive and to the rear of the tender on the left side. The air hose and angle cocks of these lines are painted red to indicate that they carry main reservoir pressure and to prevent the accidental coupling of them to the train line.

The special instructions issued by the road to those handling the locomotives equipped with the main reservoir line, cover the handling of the angle cocks when the engine is and is not being used with other locomotives. The men are cautioned against tampering with the governors, thus increasing the main reservoir pressure and particular attention is called to the necessity of frequently examining the main reservoir line hose for leaks or signs of distress, in order to prevent any failure in service. The instructions for coupling up the main reservoir line are as follows:

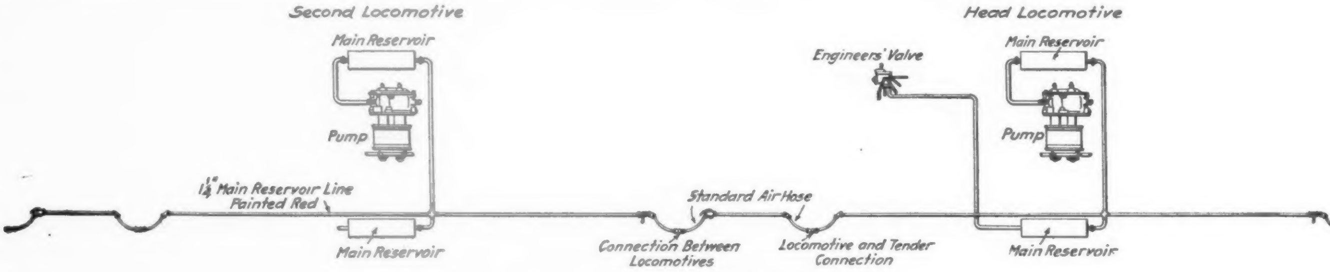
"When the main reservoir line hose have been coupled, the main reservoir pressure on both the lead and second locomotives must register the same before the angle cocks of the main reservoir line are opened between the locomotives. In other words, the main reservoir line pressure on both locomotives must be either zero, 90 lb., or 100 lb., and not zero on one locomotive and 90 lb. on the other; or 90 lb. on one locomotive and 110 lb. on the other.

"After the main reservoir line pressure on both locomotives register alike, one main reservoir line angle cock must be opened slowly to charge the air hose between the locomotives to main reservoir pressure and to prevent rupturing the hose; then the other angle cock opened.

"Before the main reservoir line is coupled up, the angle cock cutting out the brake valve on the second locomotive must be closed to prevent the second locomotive feeding the train line. The train line will be supplied and reduced by the engineman on the lead locomotive exclusively."

The instructions covering the tests to be made on the main reservoir line are as follows:

"At shops or other points where the air on locomotives is tested, the main reservoir and train lines of two or more locomotives should be coupled up and each locomotive tested separately by cutting out the engineman's brake valve on all the locomotives except the locomotive under test. The test should be made the same as if a single locomotive were being tested, but care should be exercised to observe that the brakes apply and release correctly, and that all the pumps are operating properly without shutting down before the proper main reservoir pressure is reached and maintained on all the locomotives."



Piping Diagram for Main Reservoir Line

STRENGTHENING WOODEN FURNITURE CARS

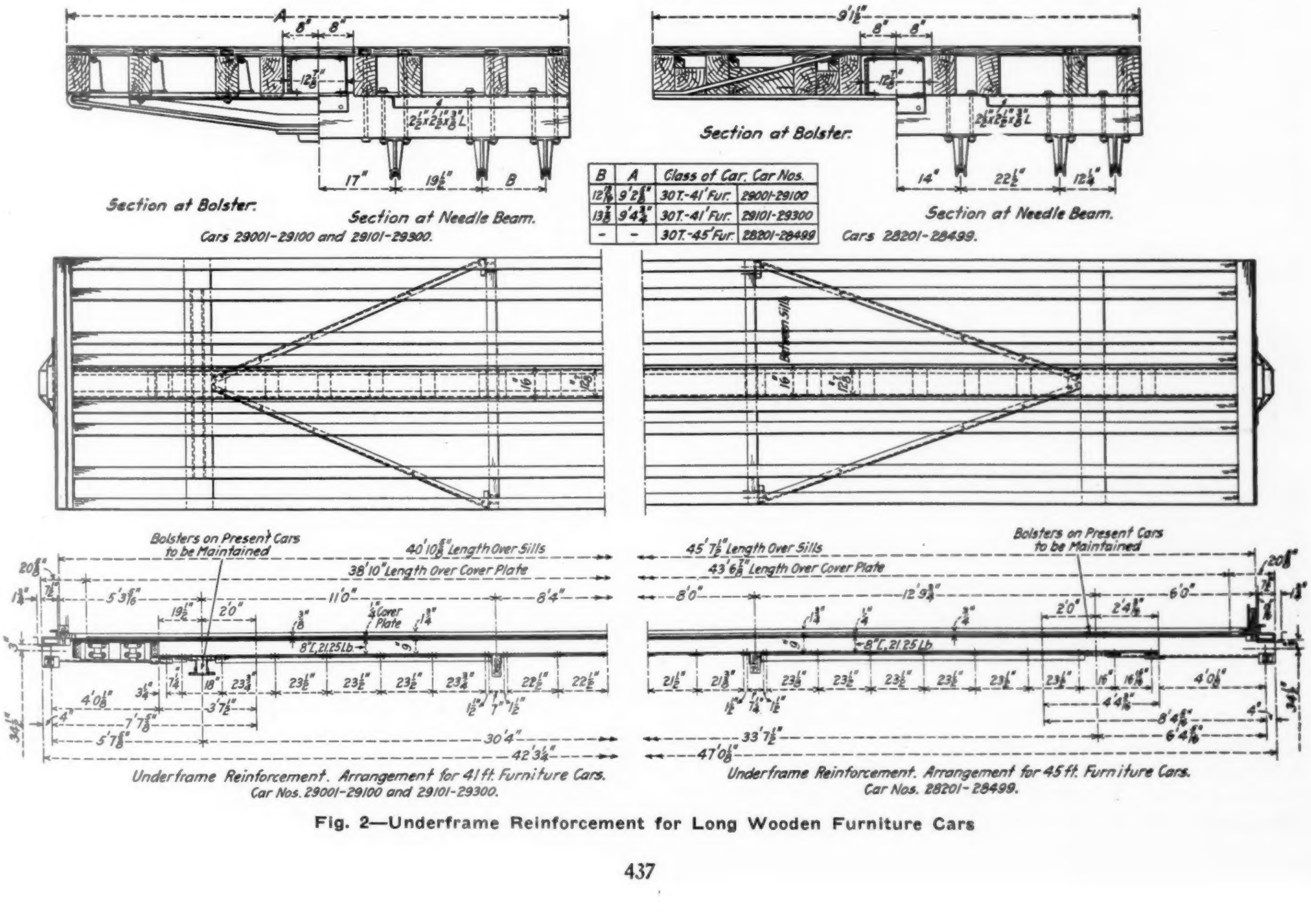
In the strengthening and rebuilding of wooden furniture cars the Illinois Central has developed some interesting methods that have served their purpose admirably. The cars

Fig. 1—Distorted Running Board Due to Weakened Construction

were more or less old and range in outside length from 40 ft. 10⅝ in. to 50 ft. 10⅝ in. Being of wooden construction and of considerable length for such cars it was found that the severe service to which freight cars are now subjected distorted them to the condition shown in Fig. 1. The cars being in otherwise good condition, a well developed plan of reinforcement was adopted.

The underframe was strengthened by the addition of two 8-in., 21¼-lb. channel draft sills, with a ¼-in. cover plate, extending for the full length of the cars. These sills were applied between the existing wooden center sills as shown in Fig. 2. The body bolsters and all other parts of the old equipment were retained. The needle beams were reinforced by 2½-in. by 2½-in. by ⅜-in. angles applied at the top, directly below the sills. In addition to this, diagonal braces were applied in the form of angles which extend from the ends of the needle beams back to the draft sills at the body bolsters. The floor was also strengthened by using 2¼-in. flooring instead of 1¾-in.

The sides and ends were strengthened by replacing the side posts with other posts 1¾ in. thicker. This necessitated bringing the posts outside the sheathing and this was done by rabbetting the post for ½ in. on each side from the outside for the siding. This is clearly shown in section Y-Y in the end view shown in Fig. 3. This was supplemented by the addition of a ¾-in. tie rod at each post extending through the sills and plates. The ends were reinforced further by diagonal strap braces 3 in. by ⅜ in., extending from



B	A	Class of Car.	Car Nos.
12 13/16	9' 2⅝"	30T.-41' Fur.	29001-29100
13⅞	9' 4¾"	30T.-41' Fur.	29101-29300
-	-	30T.-45' Fur.	28201-28499

Fig. 2—Underframe Reinforcement for Long Wooden Furniture Cars

the side plates to the end sills; by ¾-in. tie rods at the belt rails and end plates; by ¾-in. strap bolts extending from the corner posts to the first side posts; by angle plates at the belt rails, and by the addition of 1⅛-in. sheathing to the regular inside sheathing up to the loading height. These reinforcements are all clearly shown in Fig. 3.

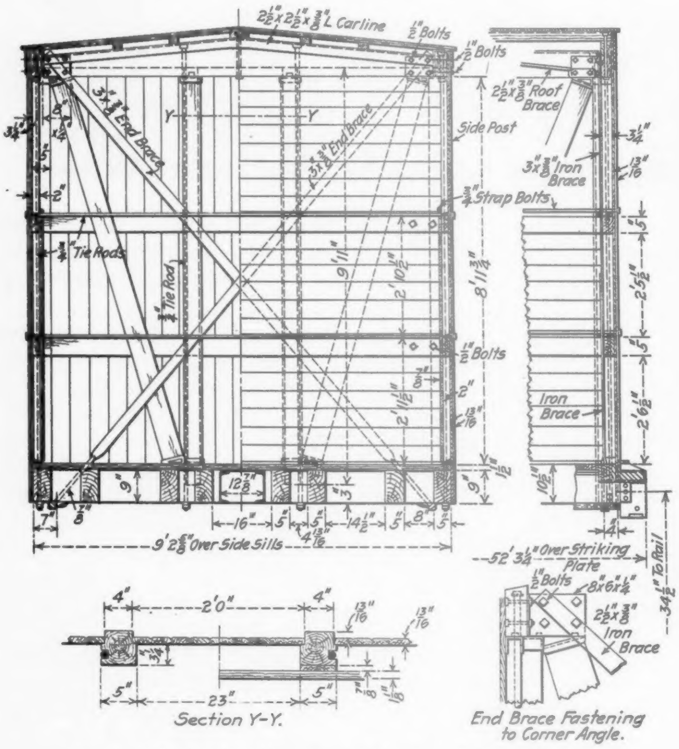


Fig. 3—End Elevation of Reinforced Furniture Cars

The roof was strengthened by the addition of 2½-in. by ⅜-in. diagonal strap braces extending from the corner posts to side plate as shown in Fig. 5. These braces are bolted to the carlines. The carlines are reinforced by 2½-in. by 2½-in. by ⅜-in. angles which are bolted to the purlines. A double board roof is used with plastic roofing between. The first layer of boards is laid flush with the side plate. The plastic roofing is then applied and allowed to extend over on to the side of the side plate. The facia is then applied, this fastening the plastic roofing to the side plate. A 6-in. strip of galvanized iron is laid on top of the plastic roofing extending down for 2 in. over the facia and on top of this the top roof boards are placed.

Fig. 4—Remodeled Furniture Car for the Illinois Central

This method of reinforcement has been applied to a large number of cars and has been found to be entirely successful. The cars are well able to meet the present day operating conditions and their life has been materially lengthened. An illustration of the finished car is shown in Fig. 4.

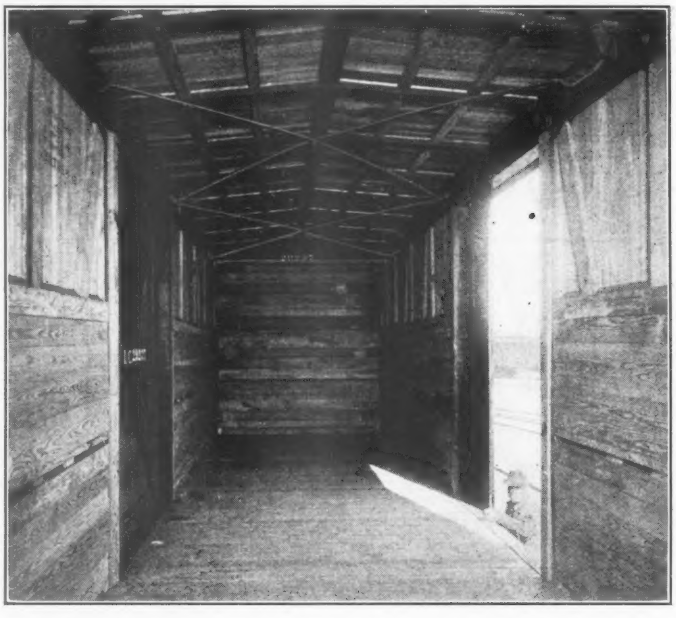


Fig. 5—Interior View of Strengthened Furniture Car Showing the Roof Bracing

BRAKE CYLINDER PRESSURE REGULATOR

In order to have some measure of relief from the evils attendant upon the use of the single-shoe brake, pending the accumulation of the funds required to meet the sometimes very great expense of remodeling trucks to provide for a suitable clasp brake rigging, a device has been designed which makes the auxiliary reservoir volume a function of the piston travel. The brake application starts with an auxiliary of very much reduced size, which keeps down the brake cylinder pressures for light brake pipe reductions. The continued outward movement of the brake piston cuts in, at predetermined points, additional auxiliary volumes, finally giving full service pressure when the proper brake pipe reduction has been made. This greater flexibility of brake operation than the clasp brake, but, of course, all the troubles and losses due to dragging brake shoes remain. This new device also arranges for the use of the first small auxiliary reservoir for all reapplications of the brake after a partial release, thereby cutting down the build-up in pressure on that retained in the cylinder and making smooth handling of long trains at low speeds much more certain.

WOMEN WORKERS IN ENGLAND.—A sidelight on the employment of women in Great Britain is indicated in the report of the Employment Exchange for 1916. The registration, presumably for those desiring positions, showed an increase of 55.9 per cent in the number of women in that year compared with the number in 1915. The decrease for men was 18.7 per cent. There was an increase for boys of 23.8 per cent and for girls of 8.3 per cent.—*Iron Age.*

*From a Paper by Walter V. Turner before the Franklin Institute.

French Box Cars Built in America

Description of 24,800-lb. Capacity Box Cars Built for Du Nord and Paris, Lyons & Mediterranean

On account of the war a large amount of railway equipment has been built in America. The freight cars built for the French railways have many interesting features in their construction. There were 4,000 built for the Paris, Lyons & Mediterranean and 1,300 for the Chemin de Fere du Nord. These cars were built by the National Steel Car Company, Ltd., Hamilton, Ontario.

P. L. & M. FREIGHT CARS

The cars built for the Paris, Lyons & Mediterranean were standard equipment, being well adapted to general service. They are sufficiently well ventilated for hauling cattle, horses or men and are equally as well equipped for hauling loose or sacked grains, baled hay, munitions and almost any other kind of miscellaneous military equipment. They are shown in Figs. 1 and 2. The principal dimensions of these cars are as follows:

Gage	4 ft. 8½ in.
Length over end sills	23 ft. 9⅞ in.
Wheel base	12 ft. 3⅝ in.
Length inside	23 ft. 7½ in.
Height from rail to top of floor	4 ft. ⅝ in.
Height from rail over body roof	12 ft. 2¼ in.
Height from rail over guerite roof	13 ft. 9½ in.
Width of car body inside	8 ft. 7½ in.
Width over floor at door opening	9 ft. 1⅞ in.
Width of door opening	5 ft. 6¾ in.
Approximate weight of car	24,500 lb.

Underframe.—The underframe of these cars is of all-steel construction, all sills being made of rolled steel shape. The pedestals for the wheels are sheared from steel plate 23/32 in. thick. These are riveted directly to the pedestal sills. These sills are 10 in., 21.8 lb. rolled steel ship channels, extending the full length of the car between end sills to which they are connected by rolled steel angle corner connections and top and bottom cover plates. The end sills are of the same rolled section as the pedestal sills and extend across the car past the pedestal sills to the side sill line, where they support the side sills and corner posts. There are four cross sills per car, of 7-in., 12.25-lb. rolled steel channels which extend between the pedestal sills and to which they are connected by rolled steel angle connections and top gusset plates of flat steel. Underneath these gussets and riveted to them and to the cross sills and the pedestal sills, are cast steel brackets for the suspension spring.

The draft sills, or draft gear guides consist of four 2⅜-in. by 2⅜-in. by 5/16-in. rolled steel angles at each end of the car extending between and passing to the end sill and cross sill nearest the end of the car. The top draft sills are riveted permanently to the end and cross sills, but the bottom ones are bolted in place and can be taken down for the removal of the draft gear. Between the draft sills at each end of the car is a steel casting, the back end of which is bolted to the cross sill and serves as a stop for the draft spring when the buffers are under compression. A single 7-in., 15-lb. rolled steel I-beam forms the center sill and extends between the cross sills through the three intermediate spaces. They are connected to the cross sills by rolled steel angle connections and flat plate top gussets. On the center and draft sills and extending the full length of the underframe is bolted an oak nailing strip for the floor.

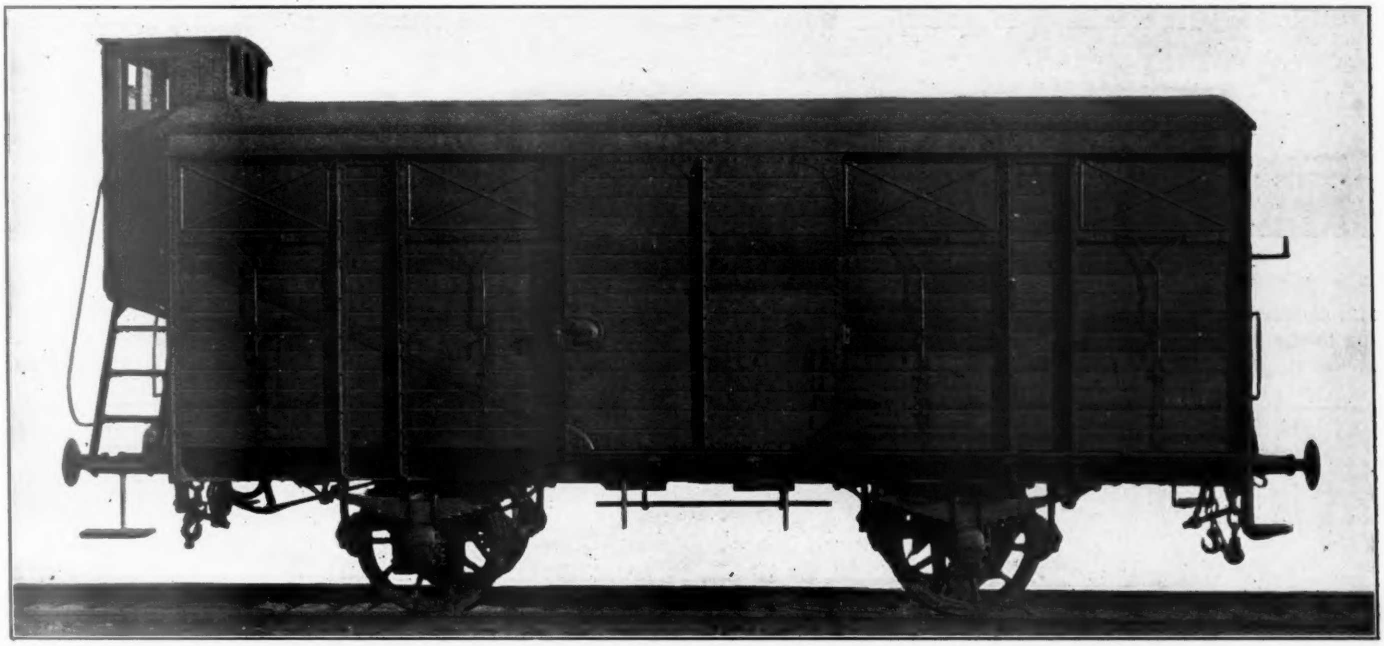


Fig. 1—Box Cars Built for the Paris, Lyons & Mediterranean With Brakeman's Box or Guerite

One large semi-elliptic spring extends almost entirely across the underframe at each end and serves both for the buffers and draft gear. These springs are supported by and slide between the draft sills, and the center spring band is a drop forging with a jaw at the front in which the forged draw hook anchors or pivots. Heavy forged buffers of the mushroom type are mounted in cast steel guides near each end of the end sills and their long forged stems extend through the end sills and cast steel inner guide and terminate in cast iron brackets fitting over the ends of the draft springs. When the draw hooks are pulled forward the inner guides for buffer stems act as stops for the ends of the springs; and when the buffers are compressed, the steel castings mentioned above act as stops behind centers of springs.

The side sills from the door opening to the ends of the car are of 3¼-in. by 2-in. by 5/16-in. rolled steel angles and

those across the door openings are of the same section with short legs sheared to 1⅝ inches. The side sills are supported at the ends by the end sills to which they are riveted and at intermediate points by braces of flat steel bars extending to the pedestal sills. The floor of the car is made of 1⅝ inches thick, yellow pine or oak boards with 3/16-in. cracks between, except over the draft gears at each end where ingot iron tongue strips are inserted.

Running Gear.—Two thousand cars are equipped with solid forged steel wheels, 40 9/16 inches in diameter, and two thousand with steel-tired wheels, having cast steel centers. The built-up wheels have tires 2⅛ inches thick and steel retaining rings. The axles are of forged steel, rough-turned and annealed. The journals are 5⅛ in. by 10¼ in. The journal boxes are of mallable iron, being cast in two iron tongue strips are inserted.

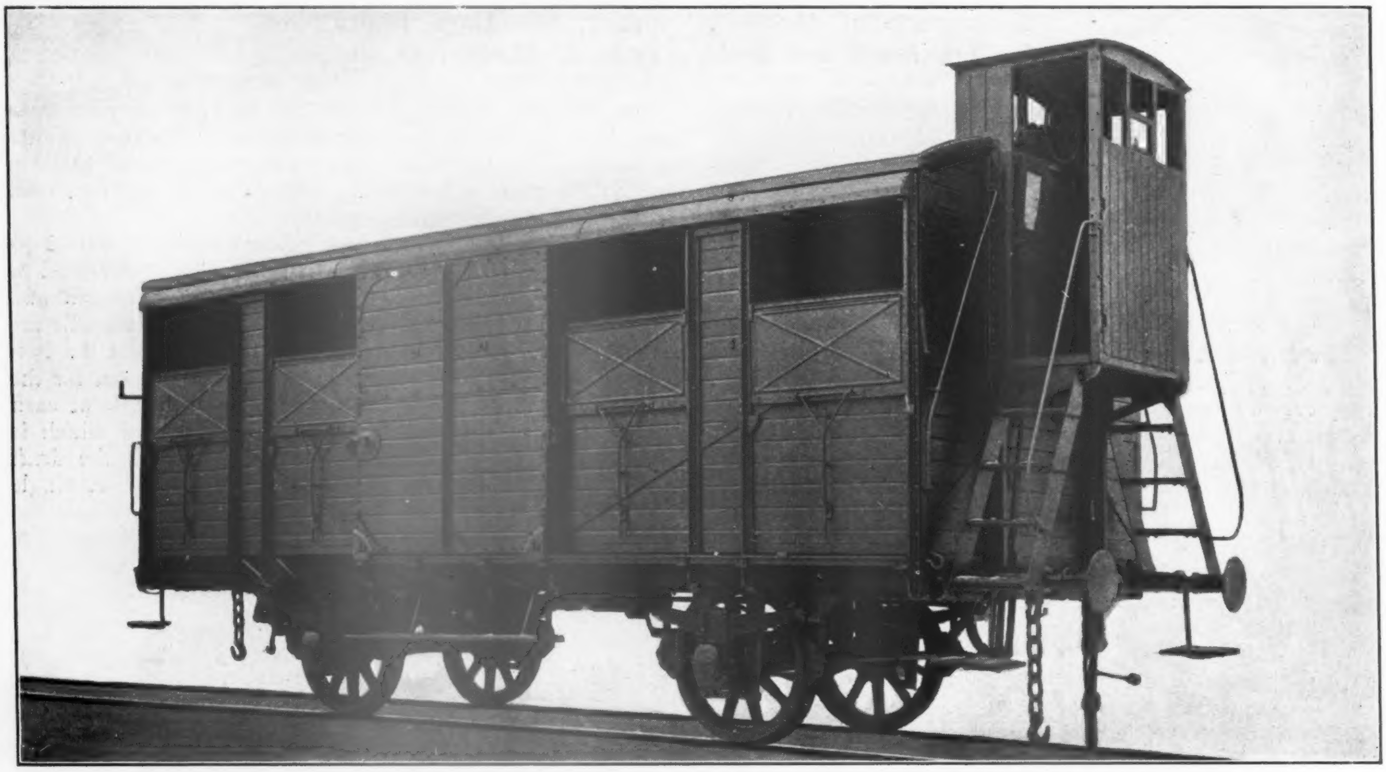


Fig. 2—View of the P. L. & M. Box Car, Showing Dropdoors in the Sides Open

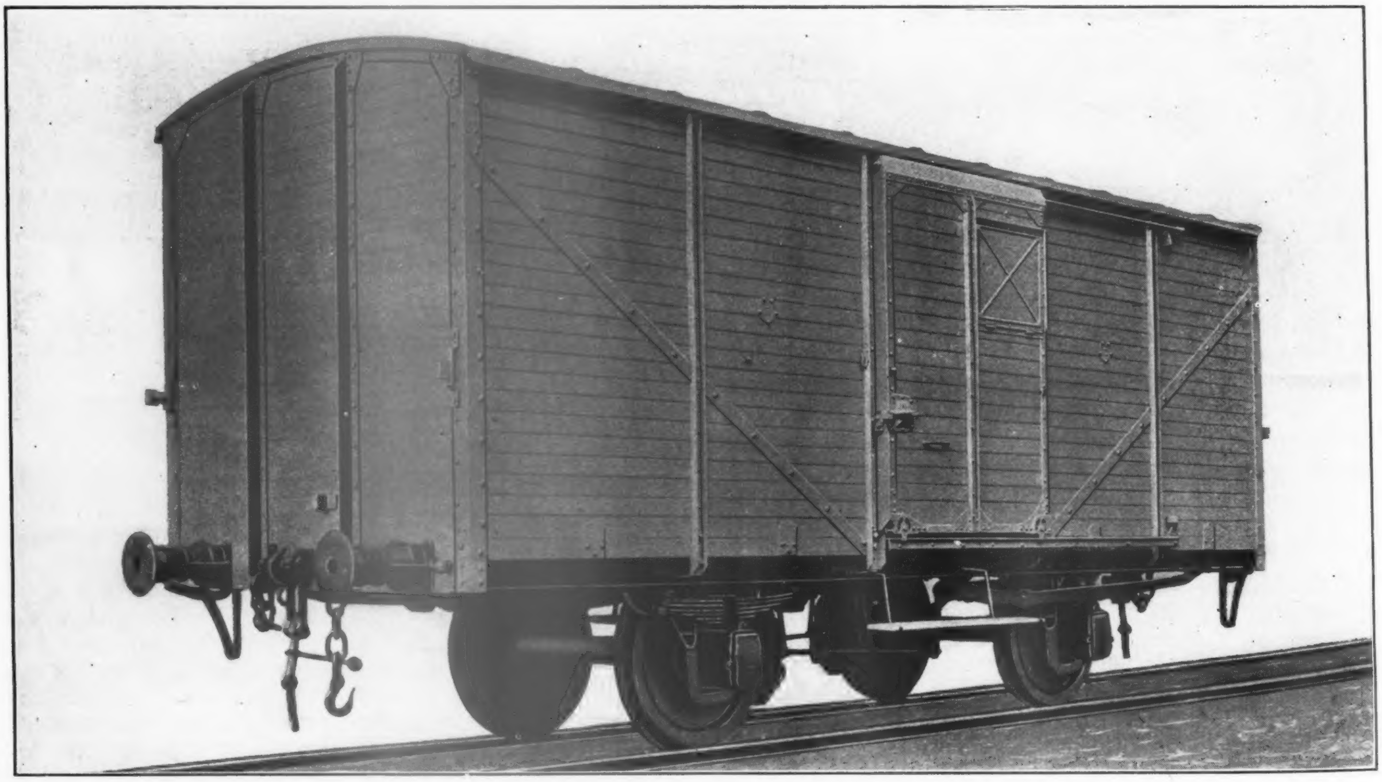


Fig. 3—Box Car of the Plain Type for Du Nord Railway

There are no journal bearing wedges, but the solid brass bearing fits the inside contour of the top of the box. The dust guards are in two pieces, being parted on the horizontal center line of the axle and having springs at the top and bottom which keep the joints closed. The dust guards are made of two thicknesses of heavy sole leather with canvass between and the edges bound in sheet steel. Oil is poured into the boxes through spots cast on the lower halves and is fed to the journals through large wicks. The suspension springs are of the semi-elliptic type seated on the journal boxes and connecting to cast steel brackets on the pedestal sills by pins and forged links.

Brakes.—The car is equipped with clasp brakes, cast iron shoes and National Steel Car Company's patented trussed beams. The brakes are operated from the guerite by a vertical hand wheel, which is bevel geared to the vertical screw shaft. The screw shaft nut is connected through forged links to a bell crank just under the end sill, and this bell crank actuates the main brake connecting rod.

The total pressure on the brake shoes with a stated force applied at the brake wheel must equal 70 per cent. of the loaded weight of the car. This is very greatly in excess of braking power as applied on cars in America, which is calculated on the basis of the light weight of the car.

Side and End Framing.—Each side of the car has one sliding door mounted on bottom rollers with a rolled steel angle track and four shutters. The door frames are of 2¼-in. by 1¾-in. rolled steel angles welded in the corners. The outside flange of the angle is exposed with wood sheathing fitted to the inside of the frame. A vertical tee of 3-in. by 2½-in. by 6.1-lb. rolled steel section forms a center brace on the outside of the door, and all corners are securely tied with flat steel gussets. The bottom corner gussets are pressed to form the outside half of the roller sheave and track guide. Horizontally across the center of the door frame and on the outside is riveted a flat steel bar which ties the side members. The upper door guide on the door is a 2-in. by 1½-in. by 5/16-in. rolled steel angle extending the full width of the door and riveted to the top of the door frame. The above guide slides between two rolled steel angles, which are supported on cast steel brackets on the side of the car.

The door is fastened by an outside drop forged hook which drops into a cast steel keeper in the door post. The hook can also be operated from the inside by a cast iron handle. The door is stopped at the back by a malleable hook which wedges into a stop on the door post and forces the door close in toward the body of the car. The shutters are of pressed steel, sliding in grooves on side posts, and they are operated by pivoted handles which drop down within reach of the operator when standing on the ground. The height of the shutter can be regulated by three forged pegs in the side washer plates which fit in a slot in the shutter handle.

The side door posts are 3-in. by 3-in. by ⅜-in. rolled steel angles and the intermediate side posts are 3-in. by 2½-in. by 5/16-in. steel tees. The corner posts are made up of one 3-in. by 2½-in. by 5/16-in. tee and one 2½-in. by 1¾-in. by 5/16-in. angle on the outside at each corner and one 2¼-in. by 1½-in. by 3/16-in. rolled angle on the inside of the sheathing. Side diagonal braces of 3⅛-in. by 5/16-in. steel plates run from the foot of the door posts to join the corner posts just below the bottom of the shutter openings. The side plates are 2½-in. by 1¾-in. by 5/16-in. rolled steel angles extending the full length of the car and are gusseted to the end plates and steel carlines. They are reinforced above the door with 5/16-in. by 5⅞-in. plate. The end plates are of the same section as the side plates. The end posts are deformed I-beams, which extend from the bottom of the end sills to the steel end plates. The spacing of the end posts of the guerite end of the car is wider than at the plain end, and to them is riveted the pressed steel cantilever which supports the guerite frame. Two end diagonals of 3⅛-in. by 5/16-in. flat steel bars cross at each end of the car

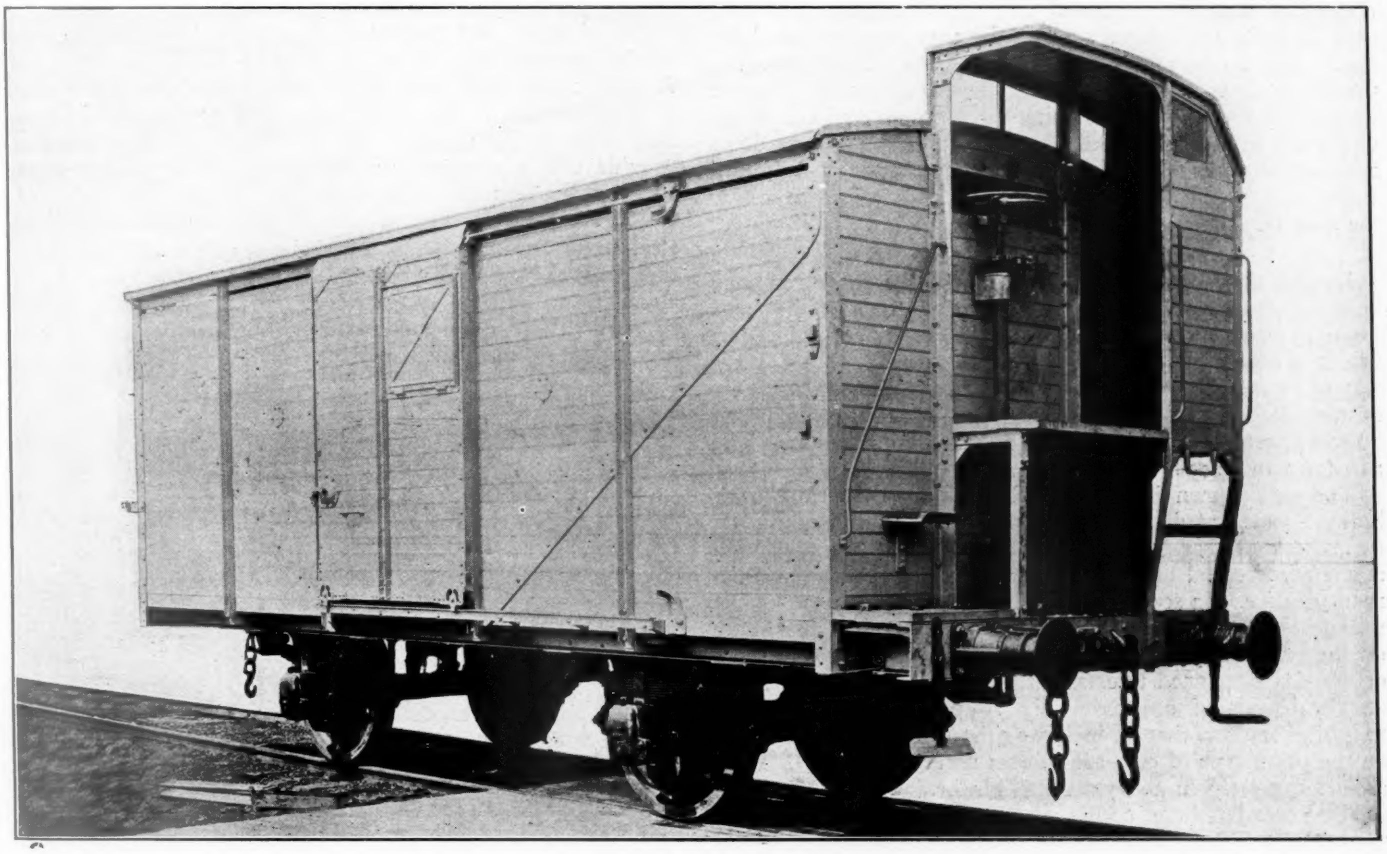


Fig. 4—Du Nord Railway Box Car With the Guerite

on the outside of the sheathing. The feet of these diagonals are blanked out of plates and welded to the bars, being illustrative of standards of work on European freight cars. The side and end boards are ship lapped fir. The thickness of the boards for a distance of 37½ in. above the floor line is 1 3/16 in.; above that point they are ⅞ in. thick.

Roof.—Tongued and grooved roof boards 9/16 in. thick are screwed directly to the wood carlines and end plates. Four of the wood carlines bolt to steel carlines formed by bending 2-in. by 1½-in. by ¼-in. rolled steel angles. The wooden end plates rest on and bolt to the steel end plates. On top of and bolted to the rolled angle side plate is a yellow pine side plate of substantial section, into which is dove-tailed the ends of all wooden carlines. This side plate is under-cut for the full length to receive the top edge of a door hood or eave strip of No. 16 galvanized steel about 8 in. wide. This forms an effective roof projection across door and shutter openings.

Guerite.—The construction of this cab is most elaborate and expensive, and it is hard for Americans to see the necessity for any such quarters for a brakeman. The guerite is framed of oak with tongued and grooved sheathing, drop sash in front and hinged sash in the rear just over the body roof, glazed doors and upholstered seats. There are two pivoted seats to each guerite and they are counter balanced with heavy castings which swing the seats up and out of the way when unoccupied. All of the framing, sashes and doors are mortised and tenoned and glued together. Steel framed stairs with forged hand rails on either side afford access to the guerite.

NORD RAILWAY OF FRANCE CARS

During the winter of 1915 and 1916 the same company built 1,300 four-wheel, steel frame freight cars of the same capacity and of similar size for the British War Office for use in France. The cars were built to the du Nord Railway of France drawings. Twelve hundred of these cars were of the plain type, as shown in Fig. 3, and the remaining hundred were equipped with the guerite, or brakeman's box, as shown in Fig. 4.

The cars shown in Fig. 3 are equipped with foot lever brakes located at diagonally opposite sides and breaking on two wheels per car. The guerite type cars are equipped with a screw brake and brake beam very similar to American railroad practice. In service a train is made up of one car of the guerite type to ten or twelve of the plain cars. The brake on the guerite type of car is of the screw type and very powerful. It is designed to exert a force through the brake shoes on the wheels of approximately 70 per cent of the gross weight of the car, that is, including the load. The foot levers on the plain type of cars are seldom used on the road. They are used mostly in the yards. This brake will be noticed in the lower left hand corner of Fig. 3, and it is applied by the brakeman running alongside of the car and dropping the foot lever from its safety catch. To apply the brake, the brakeman stands on the end of this lever, which projects beyond the end of the car.

There is a ratchet device very similar to that used in American practice, used on the screw brake of the guerite type of car. It has a helical spring applied to the brake mast, the function of which is to unwind the brake automatically upon the release of the ratchet. This ratchet dog is usually operated from the brakemen's cab, but it is also arranged to be released from the inside of the car by a conductor's cord, extending through the end of the car and attached to the dog.

The superstructure of these cars consists of a steel frame with 1-in. tongue and groove single lining. The cleats shown on the side of the car in Fig. 3, are riveted to the side sill midway between each side post to prevent the bottom post from bulging when carrying grain, etc. The small plate in the center of the panel on either side of the side doors is provided to secure a staple for hitching cattle when the cars are used in such service.

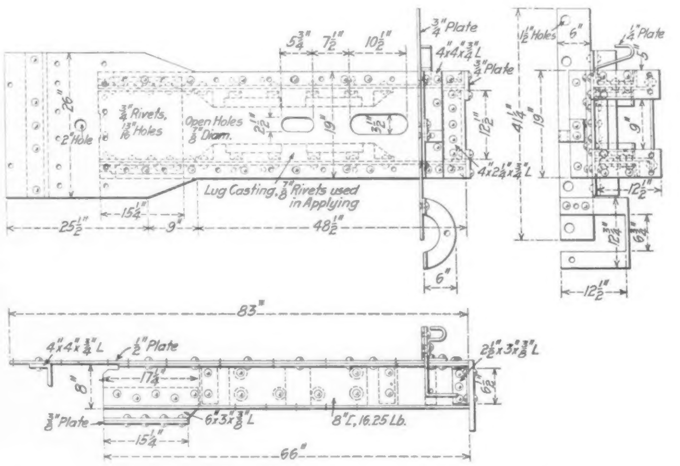
The roof of these cars is made up of angle carlines covered with roof board, on the top of which are applied flat galvanized steel roof sheets running crosswise of the car and butting over the center of each angle carline. This joint is laid in thick lead paint, on top of which is applied the wooden roof cleats, which are securely bolted through the roof board to the carlines. The underframe is of all-steel construction.

The material on these cars conforms to the best American railroad practice, the British War Department having specified, in nearly all cases, the Canadian Pacific Railway's standard material specifications. The inspection of the work during the process of manufacture was carried on by the Grand Trunk Railway System. These cars were shipped from the works of the National Steel Car Company knocked down and were erected in France. They were painted with colors suitable to produce a khaki effect when the final coat was applied "somewhere in France."

DRAFT ARM OF ROLLED STEEL

More than a year ago the E. J. & E. designed a draft arm made of plate and structural shapes for reinforcing some of the company's wooden box cars of 80,000 lb. capacity. A large number of these draft arms have been constructed at the company's shops at Joliet and applied to cars as they came in for repairs. In the design care was taken to provide ample sectional area over the bolster and extreme stiffness between the bolster and the draft gear.

The section extending over the bolster is made of a ½-in. steel plate 26 in. wide at the bolster and tapering behind the draft lugs to a width of 19 in. Two 8-in., 16-lb. channels are riveted to this plate, with the flanges turned outward. The draft lug castings, for double spring gear are riveted to the backs of the channels. Behind the lug



Rolled Steel Draft Arm for the E. J. & E.

castings the channels are reinforced with 6-in. by 3-in. by ⅜-in. angles riveted to the inside faces, with the flanges extending outwardly. The angles are connected by a ⅜-in. plate riveted to the bottom flanges which stiffens the member at this point and also keeps the channels from spreading.

A 4-in. by 4-in. by ¾-in. channel is riveted to the upper side of the draft plate outside the end sill and carries a ¾-in. by 6-in. plate extending across the end sill. Four of the truss rods pass through this plate. Across the end of the channels is fastened a 4-in. by 2¼-in. by ¾-in. angle with the longer leg horizontal which acts as a striking block. A short section of 2½-in. by 3-in. by ⅜-in. angles is riveted to the end of each channel between the flanges and ¾-in. by 5-in. plates are riveted to these angles to support the carrier iron.

SAFE LIFE OF AIR BRAKE HOSE*

There are many angles to the question of the safe life of an air brake hose, but, generally speaking, the life is what we make it. From our researches we are led to the belief that the greater portion of air hose failures is due to the destructive practice of pulling them apart, "cornering" cars while switching, couplers passing, etc. While all railroad companies have in their standard code of rules one prohibiting the pulling apart of air hose, this rule is not generally enforced, and hose are therefore subjected to abuses which shorten their life materially. In order to determine the average safe life of an air hose in actual service; or, in other words, the time that should be allowed to elapse after hose are put into service before they are removed thereby anticipating possible hose failures, inspections and records were made of a total number of 2,500 hose that were removed on account of being burst, and also inspections of 5,000 hose which were still in service. As there is such variation evidenced in the number of months' average service as between various groups of hose examined, the record of the burst hose is given in the several groups in which the examinations were made.

Number of Hose Examined.	Total Number Months in Service.	Average Life of Each Hose in Months.
446	13,333	29.8
79	2,075	27.3
370	11,358	30.4
28	694	24.4
6	426	71.0
63	2,025	32.1
61	1,812	29.7
393	11,842	30.1
528	13,728	26.0
49	582	32.0
25	904	36.0
17	459	27.0
2	213	106.0
100	2,550	25.5
100	2,725	27.25
100	2,950	29.5
133	3,990	30.0
Total 2,500	Total 71,566	Average 28.6

The hose examined while still in service showed the following average life:

Number of Hose Examined.	Total Number Months in Service.	Average Life in Months.
200	6,500	32.5
382	5,730	15.0
470	9,644	20.5
402	7,280	17.85
55	1,765	32.1
404	8,988	22.2
500	13,800	27.6
500	11,250	22.5
500	9,615	19.2
500	7,705	15.4
100	1,955	19.5
152	2,475	16.3
100	1,730	17.3
200	5,120	25.6
200	5,644	28.2
235	4,879	20.7
100	2,361	23.6
Total 5,000	Total 106,441	Average 21.3

Study of the data in regard to burst hose shows a very wide variation in the term of service, the minimum being 24.4 months, and the maximum 106 months. This latter was for only two hose. It will be noted that in spite of the fact that some few hose gave a very long term of service, the general average life of burst hose examined was but 28.6 months.

In regard to the hose still in service which were examined and which are also shown in groups, it will be noted that the average life of the various groups, as well as the general average of the whole number, is low as compared with the average life of those burst.

A comparison of the general averages as between those burst and those in service shows that the hose examined in service should continue so for 7.3 months longer.

It is the opinion of the committee that abuses to which hose are subjected, including failure to uncouple the hose by hand, are responsible for most of the damage that causes hose failures. In order to prove this statement 500 burst hose were examined for the purpose of recording the point of rupture. Of these, 245 or 49 per cent burst at the nipple end; 102, or 24 per cent, burst at the coupling end; 153, or 30.6 per cent, burst elsewhere in the hose body. Of the above number, 150 or 30 per cent, burst on the protected, or under side; 135, or 27 per cent burst on the front, or upper side, and 215, or 43 per cent, burst either on the gasket side or on the side in line with the back of coupling. Of the 245 hose which burst at the nipple end, 132, or 50 per cent, were bruised, or kinked as a result of being pulled apart repeatedly.

Examination was also made at one terminal of 16,272 hose which passed through in six days, and the following data was collected: In service less than two years, 11,790, or 72.5 per cent. In service two to three years, 3,433 or 21.09 per cent. In service over three years 1,049, or 6.4 per cent. The foregoing would indicate that not 50 per cent of the hose survived the two year limit and only 6 per cent survived the three year limit.

There was also a record kept in one big yard of the number of hose burst while getting out trains, and a record of the total number of cars handled was kept for the purpose of determining about what percentage of hose could be expected to burst in ordinary traffic. The record showed as follows: Total number of cars handled in thirty days, 284,000; total number of hose handled in thirty days, 568,000; number of hose burst during thirty days, 282; percentage burst of all hose handled 0.05; average life of the hose burst, 29.9 months.

We also made observation of the abuse, other than pulling apart, to which hose are subjected in switching. The record for one month made by one observer in only one terminal shows 148 hose ruined by cars "cornering" or couplers passing, which caused the hose to be broken or cut off from the brake pipe.

In the 148 cases observed, 30 angle cocks and brake pipe nipples were broken. In all cases the hose was absolutely ruined, and this before the trains were made up. When we consider that such abuses are of daily occurrence in many busy yards, the resultant damage to air hose may be imagined.

Except in comparatively new hose, less than eighteen months in service, the cover cracks gave little indication of the real condition or probable durability of the hose. That is to say, there were as many burst when slightly cracked as there were when badly cracked. The lesson to be drawn from this is that the surface cracks in the hose depend greatly on the ageing qualities of the material supplied by different manufacturers, but does not serve to give a reliable indication of the real condition of the interior fabric.

What may result from hose bursting in a moving train is problematical, but to say the least, the damage, delay, and expense usually involved would pay for the hose itself many times over. It would, therefore, seem a matter of economy to remove hose that have been in service 28 months, even though test may not show them to be porousing, because the foregoing data indicates that the average hose is liable to failure at any time after that length of service. We believe that if each hose made the same car mileage in the 28 months, they would all be in such a condition that failure might be expected at any time.

Removal of air hose at the time limit mentioned would increase the number of hose purchased and, therefore, the total cost for hose; hence, any economy effected would not be apparent in the purchasing and stores account, but would be reflected in the maintenance of equipment account, and in the earning capacity of the various units of equipment.

The question might be asked: Why is the average life of hose not more than twenty-eight months? The answer is:

First: Because of the rigors of the service. This involves

* Abstract of a committee report presented at the 1917 convention of the Air Brake Association.

exposure to the elements detrimental to the materials of which the hose is constructed.

Second: Pulling hose apart instead of uncoupling by hand, "cornering" cars, etc., which has such a destructive effect on the inner lining of the hose, this lining being really the life of the hose itself.

Third, and last but not by no means least: the specifications under which some of the hose are manufactured. This is not intended as a reflection on the specifications and tests, but we have information from one of the large manufacturers that to follow specifications to the strict letter would result in a hose of inferior quality at times and the manufacturer, therefore, in order to give a reasonable term of service, must use his best judgment in modifying the specifications in certain particulars.

The hose made to specification are not guaranteed for a definite term of service, and so long as the test specimens pass the required tests, there is nothing else demanded of the manufacturer. However, the materials may not at times be those that will age the best.

Another question might be asked: What can be done to increase the life of the hose?

First: With hose of the present manufacture begin the life saving in the hose mounting room. The nipple ends should be rounded off smooth. The hose clamps used in mounting should be flexible and should not be used after they have elongated sufficiently to allow the shoulders to come together when clamping the hose. Particular care should be exercised in mounting hose to see that the lining is not damaged.

Second: Every effort should be made to stop the abuse of hose while switching and have the hose parted by hand.

Third: Hose should be purchased from manufacturers whose product gives the best general results; and in order to give an idea of how far reaching this may be, the following data of the life of a number of hose of different makes is offered.

The name of the manufacturer is unnecessary, because any air brake man or engineer of tests can in a very few days obtain the same data on his own lines. The table follows:

Manufacturer.	Number of Hose Inspected.	Average Life in Months.
1	150	28
2	150	31
3	150	32.8
4	150	22.07
5	150	35.5
6	150	26.7
7	100	21.8
8	100	28.1
9	100	34.8

All of the above were removed from service on account of bursting, and it will be seen at a glance that the different lengths of service as between the lowest and highest is about thirteen months, or about 56 per cent greater than term of service from the hose of one manufacturer than that of a certain other manufacturer. This is a question that is worthy of deep consideration when we understand that one of our foremost railroad companies purchased as many as 700,000 hose in one year.

The committee feels that we should not close the paper without bringing to your attention the possibilities of a properly made braided hose as compared to a wrapped hose, and furnishing some comparisons with reference particularly to their ability to pass the M. C. B. test, and for that reason we will give a brief resume of the requirements of the tests and the ability of the braided hose to pass it.

Tensile Test.—This test cannot be satisfactorily made owing to the practical impossibility of detaching tube and cover from hose body.

Stretching Test.—This test cannot be satisfactorily made. The stocks would pass the 1913 M. C. B. Specifications but it is impossible to detach tube and cover in condition to give proper test specimen.

Porosity Test.—Test showed porosity practically nil. Hose practically all rubber in one homogeneous mass. Absorption test showed that hose totally immersed in water for one week absorbed 0.8 per cent moisture only.

Bursting Test.—Average bursting pressure 1,400 lb. Expansion at 1,000 lb. pressure 3/16 in. in circumference. Elongation practically nil. Special abrasion resisting cover used of tensile strength about the same as 1913 M. C. B. Specification. There can be no ply separation in this hose.

Friction Test.—Test cannot be made satisfactorily on account of the practical impossibility of detaching tube from cover.

Reference to the foregoing will show that the braided hose was able to pass every test to which it could be subjected, and as the price of braided hose was only slightly greater than that of wrapped hose, at the time the test was made, the braided hose should be tested out in actual service, and the matter of using it instead of wrapped hose is one well worthy of consideration.

We were not able to obtain any reliable data to show whether the burst hose examined was removed from passenger or freight equipment. However, hose in passenger service cannot be expected to last much, if any, longer, than those in freight service, for while they are not usually subjected to such rough treatment as are the freight hose, they are generally operated with higher pressures, and make so much more mileage than do freight car hose that in the ordinary course of events they could not be expected to outlive the latter.

It is a noteworthy fact that comparatively few of the hose inspected were removed on account of being porous, which indicates that this feature of hose failure is not receiving the attention it should, and your committee believes that if more testing with soapsuds was done on the repair tracks, considerable economy would result by the removal of porous hose, because they are responsible for much of the delay occasioned in getting out trains and for much of the damage incurred while braking moving trains.

The trouble experienced and damage resulting from trying to handle the brakes on leaky trains is so well known to all here present that comment is unnecessary.

The committee hopes the matter will prove sufficiently interesting so that all concerned will make a campaign to increase the life of the air hose.

The report was signed by M. E. Hamilton, chairman; Jos. W. Walker, M. S. Belk and George W. Noland.

DISCUSSION

The stresses in the hose when they are allowed to uncouple are quite high, especially with hose couplings which do not conform to the standard custom. The practice of uncoupling by hand has caused a marked reduction in the consumption of hose. Removing hose at regular intervals and testing with soapsuds when cars are on repair tracks resulted in eliminating failures. The use of hose protectors is not advisable but hose should be mounted carefully. It was suggested that it might be well to change the angle at which hose are hung so that they will be bent less when coupled.

The association voted to recommend to the M. C. B. Association that a rule be provided that air brake hose, as at present manufactured, be removed 30 months after date of manufacture.

British Steel Imports.—The extent to which Great Britain has been increasing her output of steel products is reflected in the February, 1917, statistics of steel imports. The imports of iron and steel amounted to 27,428 tons as compared with 76,125 tons in February, 1916, and a monthly average for the year of 72,740 tons. Iron ore imports were considerably greater than for the same month a year ago, the amount being 507,560 tons this year and 403,973 tons last year.

SIDE BEARING LOCATION*

BY LEWIS K. SILLCOX
Mechanical Engineer, Illinois Central

One of the refinements in the design of the average freight truck which seems to seldom receive definite attention and from the tendency of practice followed in certain sections of the country, it would appear as being entirely misunderstood, is the matter of the proper location of side bearings. The real truth of the matter has been forced on some roads through their experience with the derailment of locomotive tenders and it is made a live issue in this class of equipment principally because there is more liability for obtaining a higher center of gravity than is possible in the case of the

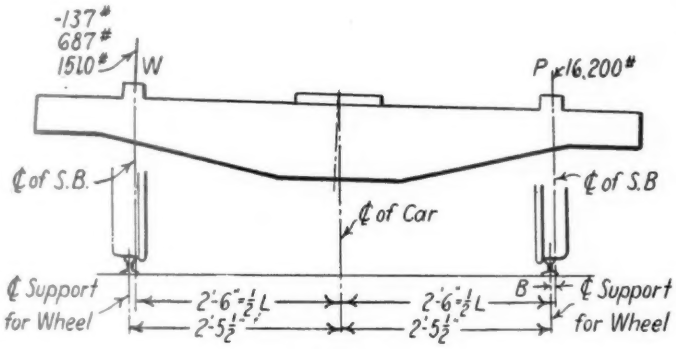


Fig. 1

usual freight car; the high center of gravity causing a great tendency for the equipment to roll dangerously. There is, generally speaking, only one remedy for such cases and that is to decrease the distance between the centers of the side bearings and this has been successful in eliminating the difficulty mentioned in most cases.

Derailments occurring in the case of freight equipment cars are so few considering the total number of cars handled that we are often led to believe that the location of the side bearings has nothing to do with the case. The raised outer rail of curved track is illustrative of track out of line, especially with respect to slow moving equipment. The same conditions may prevail at any point where the relative ele-

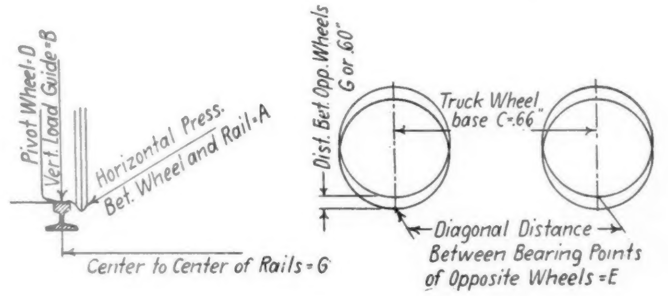


Fig. 2

vation of the rails is not uniform, because of soft spots in the track or improper ballasting.

The discussion of conditions, so far, brings up the study of the subject with respect to how far it is possible to transfer the loading to one side of the truck and still not reach the danger point, there not being enough load on the opposite side to hold the forward wheel to the rail when negotiating a curve, the forward wheel acting as a guiding element for the whole truck.

The load placed upon the guiding wheel to hold it down is in proportion to the total load carried by the wheel, which acts vertically to prevent the wheel climbing the rail. This resultant is influenced very materially by the distance from center to center of the side bearings. In order to appreciate this, we will consider the centers of the side bearings directly over the centers of the rails. In the case of a curve where the outer rail is elevated the inner side bearing is thrown over towards the outside of the rail. But this inner bearing is carrying the load and with its center approaching a point outside of the rail, it naturally follows that none of the weight of the car body is carried by the opposite wheels and therefore, no assistance is rendered these wheels in bringing them to bear on the rail. Fig. 1 shows this condition.

Assuming W equal to the weight on the left side bearing, P (16,200 lb.) equal to the weight on the right side bearing, B, the distance between the center line of the right side bearing and the point of bearing of the wheel on the rail, and L equal to the distance between the center lines of the rails, we have, under the above conditions, the following:

$$\frac{W}{P} = \frac{B}{L} \text{ or } \frac{W}{16200} = \frac{0.5}{59} \text{ or } W = -135 \text{ lb.}$$

Now if the side bearings were spaced 54 in. center to center B would equal 29.5 — 27. = 2.5 and

$$\frac{W}{P} = \frac{B}{L} \text{ or } \frac{W}{16200} = \frac{2.5}{59} \text{ or } W = 687 \text{ lb.}$$

Still again with side bearing 48 in. apart B would be 29.5 — 24 = 5.5 and

$$\frac{W}{P} = \frac{B}{L} \text{ or } \frac{W}{16200} = \frac{5.5}{59} \text{ or } W = 1510 \text{ lb.}$$

From the above, it is evident that in order to obtain any

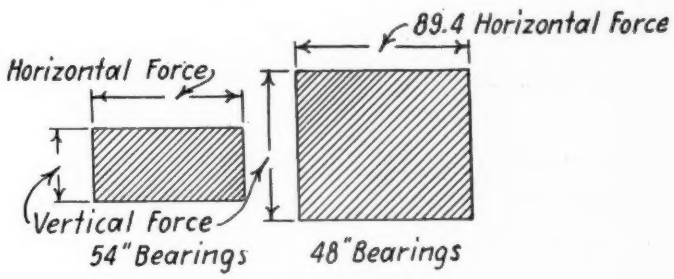


Fig. 3

pressure on the guiding wheel in the case of cars engaging curves with elevated rails, or rough track where the surface of the rails is not uniform, it is first necessary to have the working position of the side bearing inside the line of support or rail.

In order to obtain a practical idea of the problem under discussion a 40-ton car was selected and weighed on a section of scale track having a 2-in. elevation, this height being considered as representing the full compression of the springs with the initial side bearing clearance added; thus throwing the load off the center and entirely on the side bearing. The results obtained were as follows:

With side bearings spaced 60 in. center to center the weight registered was 3,100 lb. With side bearings spaced 48 in. center to center the load registered on scales was approximately 5,000 lb.

The light weight of the car was 45,000 lb. with trucks registering 6,300 lb. each and the car body 32,400 lb. Being a car of rigid construction, it was possible for the diagonally opposite side bearings to carry the entire load, 16,200 lb. going to each. The difference in the amount of weight transfer, as between the car with 60 in. and 48 in. spread of side bearings, amounted to:

$$5{,}000 \text{ lb.} - 3{,}100 \text{ lb.} = 1{,}900 \text{ lb., or } \frac{1{,}900}{16{,}200} = 12 \text{ per cent.}$$

When the car is standing normally on level track, we should expect to carry the total light weight of the body on

* From a paper presented before the Car Foremen's Association of Chicago.

the truck center plates and there is a distance of approximately 30 in. from the middle of the center plate to the center of the rail or support. At a distance 6 in. in along the bolster from the side bearing it was possible to transfer 12 per cent of the total load to the other wheel, or 2 per cent for every inch the side bearing was moved in toward the center. This rate of increase would probably be steadily maintained until the large bearing of the center plate equalized the loading, as in most cases it acts for a distance of about 5 in. all around the center.

Referring to Fig. 2 the following is assumed:

A = Horizontal pressure between the wheel and the rail.
B = Vertical load of the wheel on the rail.
C = Wheel base = 66 in.
D = Weight on pivot wheel.
E = Distance between the bearing points of diagonally opposite wheels on the rails = 89.4 in.
F = Adhesion between wheel and rail = 21 per cent of the load.
G = Center to center of rails = 4 ft. 8½ in. + ½ in. + 3 in. = 60 in.

As stated above there is no transfer of load from the inside bearing to the outside bearing when the bearings are 60 in. apart and that there is 2 per cent of the load transferred for every inch the side bearings are moved towards the center. With a car weighing (light) 45,000 lb., of which 12,600 lb. is the weight of the trucks and 32,400 lb. the weight of the body, we have for 54-in. side bearing spread

$$\frac{32{,}400}{2} \times .06 = 972 \text{ lb.}$$

of the weight of the car body going to the guiding wheels. For the 48-in. spread of side bearings we have

$$\frac{32{,}400}{2} \times .12 = 1{,}944 \text{ lb.}$$

of the weight of the car body going to the guiding wheels. This is based on results obtained from the actual tests mentioned above. Therefore, the weight on the pivot wheel *D* (Fig. 2) for the 60-in spread of side bearings* is

$$\frac{45{,}000}{2} \div 2 = 11{,}250 \text{ lb.}$$

For the 54-in. spread of side bearing spread this weight will be

$$11{,}250 - 972 = 10{,}278 \text{ lb.}$$

and for the 48-in. side bearing spread this weight will be

$$11{,}250 - 1{,}944 = 9{,}306 \text{ lb.}$$

The horizontal force acting at the guiding wheel with the 54-in. spacing is equal to:

$$F\left(B + \frac{(D \times C) + (B \times G)}{E}\right) = 0.21$$

$$\left(972 + \frac{(10{,}278 \times 66) + (972 \times 60)}{89.4}\right) = 1{,}935 \text{ lb.}$$

The horizontal force acting at the guiding wheel with the 54-in. spacing is equal to:

$$0.21\left(1{,}944 + \frac{(9{,}306 \times 66) + (1{,}944 \times 60)}{89.4}\right) = 2{,}125 \text{ lb.}$$

The graphical chart (Fig. 3) shows how the forces were practically balanced with a spacing of 48 in. in centers.

From the above comparison, it may be noted that by moving the side bearing only 3 in. in on each side of the car here considered (i. e. 54-in. to 48-in. centers) it is possible practically to equalize the vertical and horizontal forces.

The preceding figures have simply dealt with the light car body and trucks without load. As the vertical forces increase, it will be noted that a tendency prevails to accentuate the horizontal forces acting between the rail and the wheel flange, causing them to be more severe. As long as the capacity of the springs is not exceeded, they will prevent the side bearings from carrying the total load, a considerable proportion will be carried by the center plate and consequently distributed to the wheels on the far side of the truck. The great tendency, however, for most loaded cars, especially those having a high center of gravity, is to lurch towards the inner side of the curve, or the side where a low spot in the track occurs, and unless the forces acting at the side bearings are so applied as to prevent the guiding wheel from being relieved of sufficient loading to allow it to nose over the rail, great risk of derailment obtains.

Side bearing travel can be approximately calculated as follows: Multiply the distance in feet from center to center of trucks by the distance in inches from the center of the truck to the center of the side bearing, then divide this product by the radius in feet of the curve.

*The light weight of the entire car was used in the above instead of considering the light weight of the car body and the trucks separately, to make the problem simpler.

MECHANICS OF THE CHILLED IRON WHEEL*

Chilled iron possesses inherent qualities which are not found in other metals and its principal characteristics are its ability to carry any load that can be supported by the steel rail without crushing or flowing.

The mechanics of the chilled wheel have never been investigated except in a very superficial way. The fundamental properties of chilled iron, such as specific gravity, modulus of elasticity for varying tensile strengths, action under repeated stresses, relation of operating conditions to temperature stresses, etc., are not established. If the properties of chilled iron were fully understood and properly used in the wheel, a large return on the meager expenditure for investigation would flow in upon the manufacturers in the way of increased profits and to the railroads in the way of reduced costs.

The loads carried by the wheels and rails have been constantly increasing and the question now arises—are we nearing the limit for wheel loads? If so, what is the determining factor? What margin still remains for further increases, in bearing power of the metal of wheel and rail, in flange strength, in web and hub? These are the questions we propose to answer by considering each part of the wheel separately.

Bearing Power.—The bearing power of iron or steel is largely controlled by the carbon content and naturally since the tread of the cast iron wheel contains 3½ per cent of carbon it has a much greater bearing power than the rail which contains less than one per cent of carbon. A 33-in. chilled iron wheel will not perceptibly flatten under a load of 250,000 lb., which is 8 or 10 times the present maximum wheel load. Chilled iron wheels are in common use carrying 100,000 lb. or more under large cranes, unloading bridges, transfer tables, hydraulic locks, etc. To carry these loads wide special flat-top rails are necessary.

The ordinary railroad rail with a 12-in. top radius will develop a permanent set when the indentation of the wheel into the rail amounts to .007 in. If we assume that the maximum load carried in rapidly moving service should not cause when at rest an indentation greater than one-half this amount, the limiting loads from the rail standpoint are readily calculated by the formula $L = 1{,}500{,}000\ d \sqrt{D}$ in which *L* equals load, *d* equals indentation into the rail and *D* equals diameter of the wheels. In this formula the pressure per square inch over the area of contact between wheel and rail is taken at 100,000 lb. per sq. inch. The limiting loads for various diameters of wheels are:

42 in. wheels......34,000 lb.	33 in. wheels......30,200 lb.
36 in. wheels......31,500 lb.	30 in. wheels......28,800 lb.

As far as the bearing power of chilled iron is concerned there is no indication of nearing the wheel load limit.

The Flange.—The pressure which the flange must resist in guiding the truck around curves is equal to ¾ the wheel load, provided the track is perfect and the cars are in good

* Abstract of a joint address delivered before the Railway Club of Pittsburgh by George W. Lyndon, president, and F. K. Vial, consulting engineer, representing the Association of Manufacturers of Chilled Iron Wheels.

condition. The pressure is not influenced by the degree of curve, velocity, centrifugal force or obliquity of traction, but an allowance must be made for impacts originating from irregularities in track and locked side bearings and center plates, which added to the curve pressure will make the total maximum lateral pressure against the flange $1\frac{1}{2}$ times the wheel load, or 18,000 lb. for the 30-ton car and 46,500 lb. for the 85-ton car.

It is unreasonable to suppose that a flange designed for an 18,000 lb. pressure will have the same factor of safety for 46,500 lb. pressure, in fact the thickness of flange was developed when flange pressure did not exceed 8,000 lb. It is just as necessary to increase the flange section as to increase all other sections of the wheel, when increased duty is imposed. Notwithstanding the fact that the Master Car Builders' Association in its latest report stated that no increased flange width was necessary, this matter is by no means settled as far as other associations are concerned, and a movement is again started to determine whether the hundreds of thousands of flanges that are now in use (which are wider than the present M. C. B. standard flange) are not entirely in harmony with present track standards.

When this question is answered, we will have an oppotunity to present to the Master Car Builders' Association a flange with a factor of safety proportional to the load carried, which is not a difficult proposition and which from an engineering standpoint is demanded.

Stresses Within the Plate or Web.—The University of Illinois has undertaken a thorough analysis of the properties of chilled iron and of the stresses within the wheel originating from all conditions that can arise in service as far as they can be duplicated in the laboratory. These items include specific gravity, co-efficient of expansion by heat, modulus of elasticity, tensile and compressive strengths, stresses in the wheel originating from pressing on the axle, from vertical load, from side pressure on the flange, and from difference in temperature between the tread and the plate. Tests are also to be made to discover the probable difference in temperature between the tread and the plate for continuous application of various brake shoe pressures at various velocities. An indication of the magnitude of the stresses within the wheel already has been determined as follows:

From pressing on an axle having a 7-in. wheel fit at 60-tons pressure, 18,000 lb. compression per square inch is developed in the single plate; the greatest tensile stress is in the hub. If the machine work is fairly well done these stresses are symmetrical, but if the wheel is irregularly machined, the stresses will be bunched and necessarily greater than normal, being at times sufficient to burst the hub. Under a vertical load of 200,000 lb. the maximum compressive stress occurs on the radial line between the rail and the hub amounting to about 18,000 lb. in the 725 lb. M. C. B. wheel; the tensile stresses in the tangential direction are about 12,000 lb. These stresses alternate at each revolution of the wheel. The maximum stresses are in the front plate. In the back plate the load stresses are practically nil.

The stresses from vertical load within the limits of railway practice are practically negligible.

The greatest stresses, and therefore the most important are the temperature stresses; for example, a 625 lb. wheel was placed in a brake shoe testing machine and operated at various velocities under a continuous shoe pressure of 1,500 lb.; this corresponds to the retardation required for a 50-ton car on a 3 per cent grade when operated at 5 m. p. h. and on a 2 per cent grade when operated at 50 m. p. h. Thermo-couples were placed $\frac{1}{2}$ in. under the surface of the tread, under the rim, at the plate intersection and in the hub. These couples were connected by brushes to a collector ring insulated from the axle so that temperatures could be taken from any part of the wheel at any time without stopping the machine. After running the equivalent of 25 miles, the maximum stresses developed near the intersection of plates were found to be:

5 miles per hour	10,000 lb. per sq. in.
10 miles per hour	12,000 lb. per sq. in.
20 miles per hour	15,000 lb. per sq. in.
30 miles per hour	18,000 lb. per sq. in.
40 miles per hour	21,000 lb. per sq. in.
50 miles per hour	24,000 lb. per sq. in.

Since the above is a greater retardation than is required for controlling 30-ton cars it is evident that if the shoe pressure could be made uniform on all wheels of the train there would be no over-heating of wheels but there are so many opportunities for irregularities in service that at least 200 per cent above the theoretical retardation required must be taken into consideration when designing wheels. The test also indicates the great benefit of thermal or cooling stations. Making standards for the car wheel without reference to fundamental principles is absolutely unjustifiable.

We may say frankly that the work which has been done for the past eight years by our association, in conjunction with committees and other associations with which we have had to deal, has not yielded us material results; nevertheless we have gone along in our work, firmly believing that we were on the right track and that sooner or later our recommendations would be endorsed.

CUT JOURNAL—OWNER'S DEFECT*

BY F. H. HANSON
Assistant Master Car Builder, New York Central, Cleveland, Ohio

We all know the question of hot boxes and cut journals is one that is at the present time giving the railroads throughout the country an unusual amount of worry on account of the enormous amount of business they are handling. Every effort possible is being put forth by some roads to overcome this trouble by using the best steel axles, journal bearings, etc., that can be procured; also by giving special attention to truck defects, endeavoring to put the wheels and axles, journals, journal boxes and contained parts in the best of condition. Some roads have installed a system of periodical repacking of boxes on their cars at which time all journal bearings and journal bearing keys are removed and examined, journal boxes cleaned, dust guards and journals examined, and any of these parts that are found defective sufficient to be condemned are replaced. The boxes are then repacked with fresh packing. The cost of repacking varies from \$2.14 to \$3.58 per car, according to the capacity.

While it is the opinion of some that the majority of our hot boxes are caused by the so-called lack of attention on the part of the handling line, I cannot agree that this is the case. I do claim, however, that if the proper attention is given to the packing of boxes it will avoid some of our hot box troubles. On the other hand, I claim that the majority of our hot boxes and cut journals are caused by mechanical defects that cannot be detected with the naked eye at the time of application or by ordinary inspection, but after being put in service, they develop, resulting in hot boxes. Some of these defects are cracked brasses, loose lining, shell back brasses which crush when under load, pitted bearing surfaces caused by improper pouring of the brass and babbitt composition, filled brasses, malleable iron skeleton back keys, etc.

We have found when filled brasses and skeleton back keys are used (which is quite frequent) that these keys work into the roof of the journal box and in some cases become locked, crowding the journal bearing to the collar of the journal producing abnormal end wear and often a hot box. This working into the top of the journal box or wearing away of the top lugs is sufficient cause for the scrapping of one or both parts, and if not done will soon cause a hot box.

In addition to these defects that cannot be detected by ordinary inspection there are many others that are contribut-

* From a discussion before the Niagara Frontier Car Men's Association.

ing factors towards hot boxes. Some of the most important of these are broken or defective boxes allowing the oil to leak out, box lids and dust guards missing or defective, broken truck bolsters and spring planks, side bearings with insufficient clearance which prevents the alinement of the truck thus causing undue strain on the bearings, rough castings such as truck side frames and journal boxes not properly machined causing the boxes to tilt, journals not properly finished on new equipment, etc. It is a well known fact that defective journals unless running hot cannot be detected in interchange. Also it is known that journal bearings that are rejected at the manufacturers by our material inspectors for minor defects and non-gaging are purchased and used by certain railroads and private car lines.

In order to know the true condition of the bearings in some of our cars, we had a record taken of the different defects found when examining the bearings while cars were undergoing repairs, and out of a total of 5,668 bearings examined, 116 or 2 per cent were defective, due to the following defects: Uneven bearings caused by defective arch bars or truck sides, end wear, due to trucks being out of alinement (in some cases the end wear was so great as to greatly reduce the area of the bearing surface), babbitt worn thin and cracked with pieces becoming loose and dislocated.

This seems to show clearly some of the defects that do actually exist which cannot be detected by ordinary inspection, but which will soon cause a hot box and perhaps a cut journal, and when this does occur it should be properly chargeable to the car owner. This, I claim, also shows the necessity of removing and examining these parts at certain intervals, which is not being done by some car owners.

To verify this, we recently had the packing removed from about 200 foreign cars and found 28 cars with the packing in very bad condition, and which might be termed as worn out. Out of the 28 cars 9 were private lines cars, which had recently been given a general overhauling as follows: One in December, 1916, and eight in January, 1917.

These conditions plainly show no attention, whatever, had been given to the condition of the boxes on these nine cars when they were in the shops for repairs. Is it not fair to assume that if cut journals were at this time a car owner's defect that the trucks under these nine cars would have been given the necessary attention by the owners when giving the cars general repairs? The packing at least would have been given the necessary attention. The old saying of "An ounce of prevention is worth a pound of cure" applies as fully in such cases as any that could be cited.

Again, some car owners are still using wrought iron axles, and it is claimed to be almost impossible to manufacture wrought iron axles that are free from seams owing to the character of the scrap iron used in them. It has also been stated that in Europe, where the low carbon steel axle is used, they seldom have a hot journal, and consequently it seems to be the opinion of some axle manufacturers that the softer texture of steel would tend to reduce the liability of hot journals. All of which goes to show that the majority of hot boxes are caused by some mechanical defect or combination of defects.

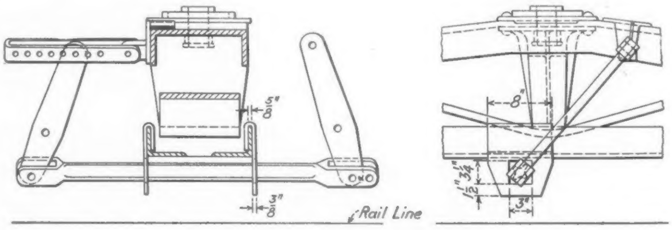
One of the important decisions made by the M. C. B. Arbitration Committee is its interpretation of Rule 85, as shown in M. C. B. Circular 20, making the car owner responsible for a cut axle caused by a brake chain or brake rod bearing on the axle. If a defect of this kind that is plainly visible and might be attributed to the carelessness or neglect of the handling line in not properly adjusting the brake rods, brake chain, etc., has been placed among the car owners' defects, surely the time has come for the cut journal caused by concealed mechanical defects to also be made an owner's responsibility.

Consider the case of a car received at an interchange point with no evidence of any defect. Suppose the boxes of this car are given attention and the brasses and keys from all outward appearances are in good condition. The packing is thoroughly stirred and additional packing or oil is added, if needed. The car goes forward, but after running a few miles a hot box develops, and on examining the brass and journal it is found that a new brass is needed, which is applied, and a bill rendered against the car owner, which is proper. Carry this case a little further, and suppose, on examining the journal, it is found to be cut. Then, according to the present M. C. B. rules this pair of wheels must be removed, the journal turned up and replaced or another pair of wheels applied in their stead at the cost of the handling line.

With all fairness to both the car owner and the handling line—is it fair to penalize the handling line in such cases? Surely it cannot be attributed to lack of attention on the part of the handling line, and if not, it certainly should be an owner's defect. When it is made an owner's defect, I claim we will soon see an improvement in the condition of the boxes, for the owners will then pay some attention to these conditions, knowing that any trouble they can prevent due to hot boxes while car is on foreign line will prevent a bill from being rendered against them. I further contend that this will work out to the best interests of both the owner and handling line. The time has passed for us to say that the majority of our hot boxes could be prevented by the exercise of proper care by the handling line.

SAFETY HANGER FOR BRAKE RIGGING

The Elgin, Joliet & Eastern has applied to a large number of its cars a simple and effective form of brake rigging safety hanger. It is shown attached to a truck in the illustration. The safety hanger is made of ⅝-in. plate, fitted over the flange of the spring plank and having a hole through which the bottom brake rod passes. While the design shows the device applied to a truck having a spring plank composed



Brake Rigging Safety Hanger

of two angle irons, a similar arrangement can be used on trucks having spring planks of other types. The feature of this type of safety hanger which makes its use particularly advantageous is the fact that it affords protection to the brake rigging from practically all failures. Whether the failure is due to a bottom rod breaking, pins working out or the brake hangers giving way, the safety hanger keeps the rigging from dropping and being torn off or causing a derailment.

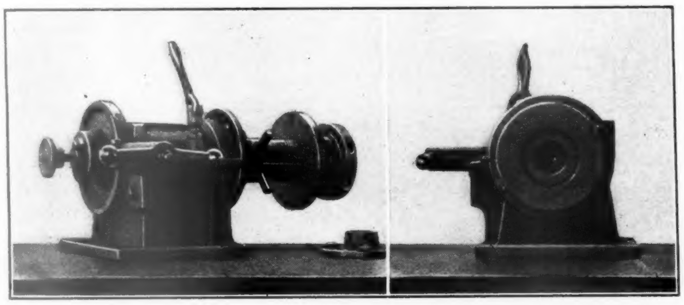
TECHNICAL PROPRIETY IN ENGINEERING SOCIETIES.—However laudable may be the desire to maintain the proceedings of our great engineering societies on a high plane of technical propriety, it cannot be denied, even though it has been ignored in the past, that the engineer is everywhere confronted in his work by the all-important question of costs and balance sheets, and himself is usually under the necessity of earning a livelihood by his profession. Hence, an ostrich-like pretense that trade and finance have no concern for him is mere affectation, and we are glad to see that both the civil and electrical engineers have begun, somewhat shyly it may be, but effectively, to recognize their responsibilities in this connection.—*The Electrical Review* (London.)

SHOP PRACTICE

HANDLING RODS AT MACON SHOPS*

BY C. L. DICKERT
Superintendent of Shops, Central of Georgia, Macon, Ga.

When locomotives are stripped all rods, brasses, etc., are sent to the cleaning vat for cleaning, being handled from the engine to the vat by an overhead traveling crane. The cleaning vat is located at the end of the erecting shop. All parts that are to be cleaned are placed in a basket large enough to hold all parts from one locomotive. This basket is placed in the vat in the afternoon and allowed to soak over night. The first thing the next morning the basket is removed and placed on the floor and the parts are washed with clear water. The rods are then delivered by a special gang of laborers to the rod gang, where they are thoroughly inspected for cracks, worn eyes, worn or cracked straps. If the rods or straps are bent they are sent to the smith shop for straightening. If the straps are worn they are sent to the smith shop to be closed and they are re-slotted when heavy enough to be reworked. When they are cracked or are too light new straps are made. We do not weld cracks in the rods or straps. Where the rod eyes or knuckle pin holes are worn they are carried to a horizontal boring bar by a traveling crane, and the rod eyes are bored true and the knuckle pin holes are reamed.



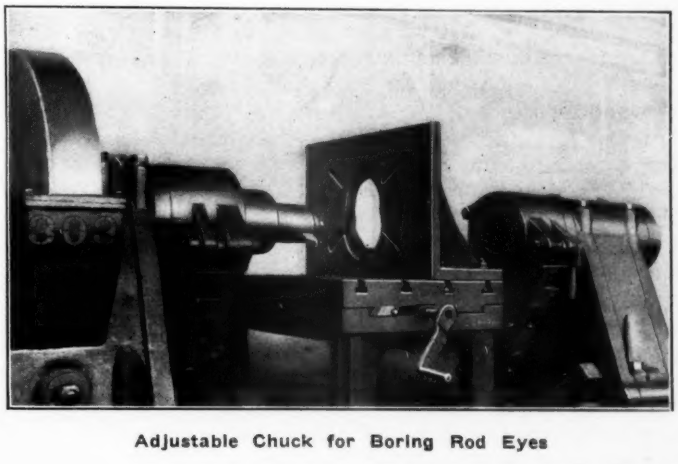
Chuck for Slotting the Strap Fit in the Main Rod Brasses

Before the rods are removed from the pins, when stripping the locomotive, the foreman or some competent man determines whether or not the bushings need renewing. If all or part of the bushings are good, the foreman notifies the leading man in the rod gang. This eliminates the necessity of the rod gang men calipering the pins to see whether or not the bushings need renewing. Frequently rod bushings are applied in the roundhouse just before the locomotive goes to the back shop and do not need renewing. When the collars are removed from the crank pins, it takes but a few minutes to inspect the bushings. When new bushings or main rod brasses are needed, a storehouse ticket is issued giving the pattern number of the brass. This ticket is placed in a ticket receiving box, several of which are conveniently located throughout the shops. Messenger boys from the store department visit these ticket boxes every twenty-five minutes during the day, gathering up tickets and taking them to the store house. The store house force fills the orders and delivers them promptly to the department ordering the material. If the material wanted is not on hand the store house clerk writes on the ticket "Not on hand" and returns it to the foreman issuing the ticket.

All rod, knuckle bushings and main rod brasses are turned and bored on a Bullard boring mill. We find that the work can be done much quicker on this machine than on an engine lathe. The main rod brasses are machined for the strap fit on a Dill slotter, special chucks for the brasses being fitted to the slotter. Better time is made on this machine than can be made on a shaper. All rod strap bolts up to and including 1½ in. by 16 in. are turned on a Lassitter four-spindle bolt turning machine, and are carried in the store stock. When bolts are needed for a set of rods, they are cut to length on a bolt altering machine and threaded in a bolt cutter.

All knuckle and wrist pin blanks are made on a 6-in. Pond turret lathe and carried in stock. When they are needed they are threaded and cut to length in the turret lathe, leaving only the bearing and fits to be made. Knuckle pins for all classes of locomotives have a taper for the fits of 1¼ in. in 12 in.; the wrist pins have a taper of ⅝ in. in 12 in. Having one taper for the fits on all classes of locomotives makes less work for the tool room in the maintenance and manufacture of reamers. The rod keys are forged on a drop hammer. The rod wedges are made of cast steel. The rod wedge bolts are made on a turret lathe and are carried in store stock.

The rods are forged from the best hammered iron and are planed and channeled on a slab milling machine. The ends are finished on a vertical miller, the knuckle jaws being milled on a No. 5 Ingersoll milling machine. The rod eyes are bored on a Newton cylinder boring bar, a special chuck being made to fit the machine for this class of work. All grease cups are made solid on the rods when they are forged. The cups are drilled and tapped on a heavy drill press. Grease plugs are made of malleable iron;



Adjustable Chuck for Boring Rod Eyes

*Entered in the Rod Job Competition.

they are machined in quantities and carried in store stock being drawn when needed.

The machines in the rod group consists of one 18-in. engine lathe, one shaper, one boring bill, one power press, one cold saw, one drill press, one sensitive drill press, one disc grinder, one swing grinder, one slab miller, one vertical miller, two face plates and two work benches. All holes are reamed with an air motor. The rod group is served by the shop traveling crane and one jib crane. All rods are lifted with cranes and handled between departments with the Hunt system of industrial tracks. Thus the least possible amount of labor is required to handle the rods from the time they are removed from the locomotive until they are applied. When the rods are finished they are delivered to the erecting shop by the department doing the work. This method of handling simplifies deliveries, as each department keeps the work moving and enables the foremen to keep their departments clean.

HAND TOOLS AND SAFETY FIRST*

There are still many operations that require the use of hand tools in a machine shop. Among these are filing, chipping, benchwork in general, and blacksmithing. The thought of danger is specially associated with moving machines, but although these do cause a great many accidents, a surprisingly large proportion of the injuries received in machine shops results from the use of hand tools.

The possibilities of accidents in connection with machines are easily apparent. The swift, untiring motion, and the grinding, clattering, and whirring sounds, suggest relentless force; and while machines are in motion, contact of any portion of the human anatomy with certain parts of the machines almost inevitably results in personal injury. Carelessness may or may not be an important factor in an accident of this kind.

Hand tools, however, are apparently quite harmless; yet (as stated above) they cause many accidents, and nearly all such accidents may be fairly attributed to personal carelessness or neglect. Mishandling tools, neglecting to keep them in good condition, and leaving them about in dangerous places, are forms of carelessness that cause trouble sooner or later.

Suppose a machinist is about to file a piece of work in a lathe. Handles come off from files quite frequently, and they are not always easily found when wanted. In the hypothetical case that we have in mind, the machinist starts to work with a file that is minus a handle. When working close to the lathe dog the end of the file is struck by the dog and the pointed tang is forced backward into the man's hand or wrist, or possibly into his abdomen if he is standing directly in line with the file. A similar accident may occur while working at the bench if the file breaks, or if it slips in the workman's hands, although the results are usually less serious in a case of this kind. *Never use a file without a handle.*

A painful accident sometimes occurs when a workman, in attempting to drive a file more firmly into its handle, grasps the tool by the handle instead of by the metal part. A heavy file will sometimes drop out in a case of this kind, remaining balanced in a vertical position on the bench for a moment, so that the man's hand or wrist comes down violently upon the sharp tang. *In tightening a file by pounding on the bench, always grasp it by the metal part, instead of by the handle.* Some shops use safety handles of special design. In one form a hardened steel nut with sharp threads is inserted in the handle, and the handle is twisted on with considerable force. The sharp threads of the nut then cut into the tang and hold it securely in place.

Another man may be setting up a large nut with an open-end wrench that is a trifle too large for the nut, or the jaws of which have been battered or twisted out of shape by mistreatment. In either case the wrench is likely to slip off the nut, and the workman's knuckles may come in contact with some hard object and be cut and bruised, even if nothing more serious occurs. *Use a wrench that is in good condition and of the proper size.*

Workmen often use monkey-wrenches for hammering, and thus damage the jaws or the adjusting screws, so that when the wrenches are put to their proper use the jaws slip around the nuts and more knuckles are bruised and require attention. *Never hammer with a monkey-wrench.*

Similar bruises often result from applying monkey-wrenches improperly. If the wrench is used in the position shown in Fig. 1, for tightening a nut, the jaws are likely to spread and to slip off the nut when force is exerted upon the wrench handle. The correct method is shown in Fig. 2. When the wrench is used in this way the pull on the handle tends to tighten the jaws, and thus causes them to grip the nut more firmly. As an additional precaution, avoid using a monkey- wrench as a substitute for a socket wrench, whenever possible.

A chipper who fails to wear goggles and to provide a needed screen to protect other persons against flying chips from his work, has only himself to blame if the chips strike his own eyes, or those of some other person, and cause painful injuries.

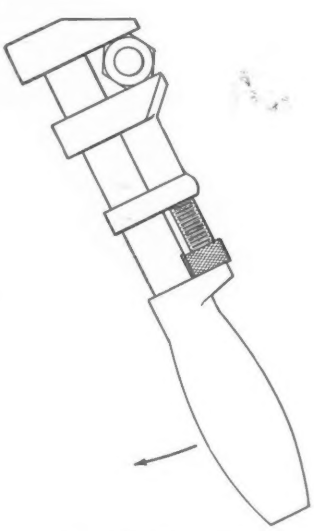


Fig. 1—Wrong Way

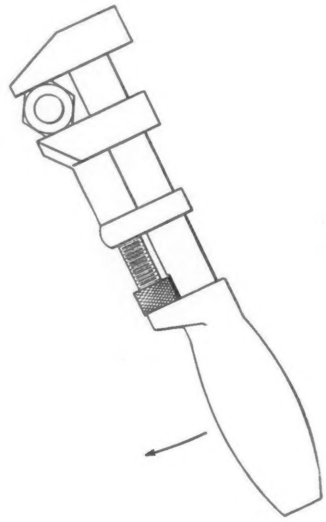


Fig. 2—Right Way

The danger associated with the use of punches, cold-chisels, hand drills, and other similar tools, when the heads are worn, burred, or "mushroomed," has been pointed out by nearly every writer on safety topics. Men continue to use these defective tools, however, and, as a result, from time to time flying burrs or spalls that break off inflict cuts and bruises on the arms or faces of the users, or of persons near by. When the flying fragments of metal strike the eye, the result is likely to be a permanent injury or even a total loss of sight. Furthermore, when the tool being struck has a burred head, the hammer is more likely to slip off and injure the hand that is holding the tool. *Have chisels and other similar tools dressed whenever the heads are burred.*

No workman should knowingly use a sledge hammer that is loose on its handle or that has a split handle, nor any other defective tool. If the tools are the individual property of the workman, he should inspect them frequently and have them put in good condition before using them; and if they belong to his employer he should notify the foreman if they are defective, and insist on having safe implements. A good plan is to have all hand tools, and particularly such

* Taken from The Travelers Standard for July.

tools as sledges and others with wooden handles, kept in the tool room, to be checked out only when needed. In this way one man—the tool-room keeper—can be made responsible for seeing that no defective tool reaches the hands of a workman.

Tools left lying in passageways, and near the edges of platforms, benches, racks, and shelves, and on step-ladders, are potential accident producers. "A place for everything, and everything in its place" is the safe rule for sharp-edged, heavy, and otherwise dangerous tools.

Insecurely placed work—perhaps a heavy casting or forging—often falls from the bench, endangering the feet and limbs of the workman. Avoid this danger by keeping such objects in safe positions, and by properly supporting or securing them, whenever necessary.

Every machinist doubtless knows that striking tempered steel with a steel hammer or other steel or iron implement endangers the eyes, but every little while somebody tempts Providence by trying the experiment again.

When cutting a short piece from a rod or bar of metal with a sledge and a blacksmith's cutter, the short end, when severed, is likely to fly and injure someone, unless care is used to strike lightly when the rod is nearly cut through. The smith also knows (or should know) that to avoid flying pieces he must stand at one side when doing this work.

Broken and bent tongs and tongs that do not fit the work are unsafe. Repair all broken tongs at once, or put them in a safe place where they will not be used. Don't hang hot tongs in the rack, because someone may grasp them with the intention of using them, and be severely burned.

Contrary to safe practice, pieces of hot metal are often left lying about on anvils, benches, and other places, and these may burn any person who attempts to pick them up. Mark hot pieces in some unmistakable way, so that burns from this cause will be avoided.

Finally, there is the ever-present danger of infection that is associated with even the slightest wound or abrasion of the skin. Such injuries are daily occurrences in machine shops, and are often considered too trivial to require attention. Nevertheless, they frequently lead to serious cases of blood poisoning.

The lesson that we desire to teach and to emphasize in this article is "Exercise greater care in the use of hand tools." Forget the *apparent* harmlessness of these implements, and remember the capacity that they have to cause suffering, when mishandled or when used carelessly or negligently.

CONSERVE MATERIAL

The Seaboard Air Line in its Store Department Bulletin for July has made a very strong appeal for the conservation of material. It applies so aptly to all railway shops that it is reproduced, in part, below:

"Do you find the prices being lowered on any articles you may buy for your personal use? On the other hand, they are being constantly increased.

"The Seaboard is feeling this same condition, and the dollar it spends for material and labor does not go any farther than your dollar. On the other hand, many of our employees have received increases in wages, whereas the railroad must shoulder these increases in labor and material and operate on the same rates. In the face of such conditions, we must economize in the use of material in every way.

"We can all do more than we have done. It has been necessary on account of enormous increases in the price of material to conserve it in every way. Practically every item of material which we use can in some state be used for war purposes. It is now a patriotic duty of every employee to conserve iron, steel, lumber and other material, so that any excess may be available for war purposes—*do your bit.*

"There is a serious shortage of steel products. The Government has served notice on mill owners with reference to the steel output for building ships. We can not expect the deliveries which we have had in the past, and prices have already increased over 400 per cent. As is the case with many other items, bar iron and sheet steel should only be used when absolutely necessary. Save the stocks of iron and steel by using second-hand and scrap.

"Every mechanic, foreman and employee should devise methods of saving material. We must admit that we can make savings, and savings are being made in many ways by a thorough investigation. Every officer and employee should do his full duty to conserve the use of material and only make a requisition for material when a full knowledge of conditions warrants the money being spent. As recently stated in a circular by President Harahan, 'Every requisition for material and supplies should be scrutinized with the greatest care, and full knowledge of conditions which exist. By close co-ordination and discouraging calls for hundreds of small items of material and supplies, we can greatly reduce our purchases without impairing maintenance and operation of the railroad.'

"Following are prices of material January 1, 1915-1916-1917. We cannot reduce the price. The only way to make a saving is by reducing the use, and properly protecting material after purchase. Save your material.

	1915	1916	1917
Axles, Driving ....(lb.)	$0.03	$0.04¼	$0.06½
Brass Castings ....(lb.)	.12	.14	.29
Brooms ....(each)	.25	.28	.57
Coke ....(ton)	3.65	3.76	7.00
Chain ....(cwt.)	2.44	3.05	5.65
Castings, Malleable ....(lb.)	.03½	.04½	.06¾
Castings, Steel ....(lb.)	.03½	.04	.09
Couplers ....(each)	9.00	9.80	14.75
Gasoline ....(gallon)	.09	.13½	.19
Iron, Bar ....(cwt.)	1.15	1.76	3.27
Iron, Galvanized Sheet..........(cwt.)	1.94	4.44	7.25
Nails ....(keg)	1.65	1.95	3.25
Nuts, Hex, ⅞ in..........(keg)	7.86	12.96	26.10
Nuts, Square ....(keg)	3.92	6.08	10.25
Pins, Knuckle ....(each)	.17	.25	.42
Rivets ....(cwt.)	2.00	2.52	4.24
Roofs, Car ....(each)	24.00	26.00	44.21
Siding ....(1,000 ft.)	12.50	14.00	18.50
Steel, Firebox ....(cwt.)	1.74	1.90	4.57
Steel, High Speed..........(lb.)	.55	2.50	2.55
Tubes, Boiler ....(ft)	.07¾	.11	.21
Tires, 6 in. Flange 65 in..........(set)	238.46	248.21	475.64
Wheels, Rolled Steel, 36 in..........(each)	22.84	23.04	37.58
Waste, Wool ....(lb.)	.05¼	.06	.11
Waste, Cotton ....(lb.)	.04¼	.05¼	.10

AUTOMATIC OIL FILTER

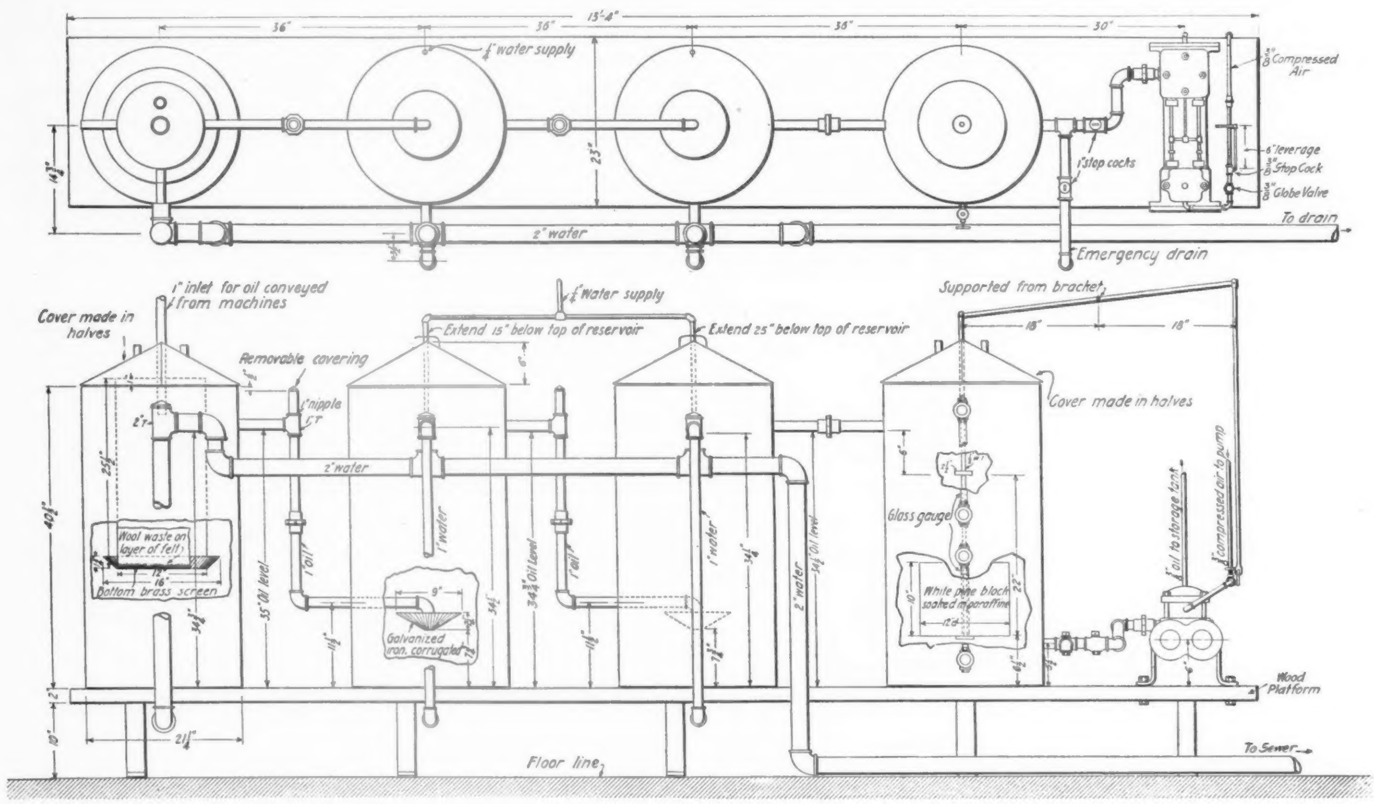
BY E. A. M.

An arrangement for filtering and reclaiming the oil from stationary engines, machines, pumps, air compressors, etc., which has been giving excellent service during the past two years, is shown in the illustration. This arrangement is designed to work automatically; the oil from the power units flows to the filter by gravity and a pump which is operated by a float returns the oil from the filter to the storage tank from which it is used again. Its use has clearly demonstrated its practicability and since it was designed five others have been built.

The filter consists of four tanks of 21¼ in. in diameter. The oil is received in a small tank of 12 in. in diameter which is located in the tank at the left of the illustration. This small tank is 25½ in. high, extending 1 in. above the top of the large tank in which it is located. The bottom of this small tank is a brass screen of fine mesh on which is placed a layer of felt and above that a little wool waste. The oil from the power units is filtered through this material to remove the dirt. It passes on to an inverted, corrugated umbrella-shaped pan which tends to break the oil away from the water. The oil rises to the top of the tank and the water passes to the bottom. When the oil reaches a level of 35 in. in this tank, it passes out through a 1-in. pipe to a similar corrugated umbrella pan in the second tank. The water

passing out through the bottom of the tank through the 2-in. water line, passes up through a riser to a height ¼ in. below that of the oil. The water drains off through the 2-in. water pipe shown to the sewer.

The water and the oil in the second tank become further separated, the oil rises to a height of 34¾ in. when it passes



Arrangement of an Automatc Oil Filter

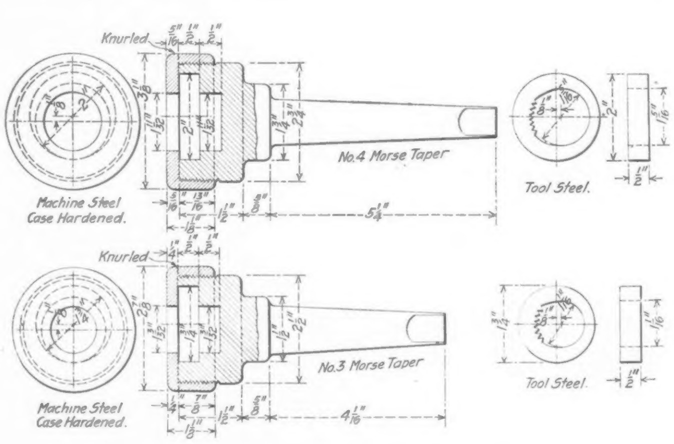
over into the third tank. Similarly, the water this time passing up through a 1-in. pipe to a level of 34½ in., or ¼ in. below the level of the oil, passes off to the sewer through the 2-in. water pipe. The same process is carried through in the third tank. Inasmuch as but little water is obtained from the oil in the second and third tanks, a small amount of water through a ¼-in. water supply is admitted to these tanks at a point 15 in. below the top of the reservoir to assist in operating the system. By the time the oil reaches the fourth tank it is in first-class condition. From there it is pumped to an elevated storage tank for distribution. The pump is automatically operated by a white pine block soaked in paraffine which is 12 in. in diameter and 10 in. high. This block rises with the oil until it strikes a washer forged on the rod on which the block slides. The buoyancy of the block is sufficient to work levers starting the pump. A similar washer at the bottom of this rod catches the float as it lowers to the bottom of the tank and shuts off the pump. There is a difference of ¼ in. in the oil level in the different tanks except between the third and fourth. This insures a positive flow of oil between them.

SAFETY FIRST.—The Great Western Railway (England) statistics as to accidents to its employees showed, up to 1913, an almost invariable tendency to increase. In 1914, however, this tendency was arrested, and, whereas in 1913 the increase was 11.2 per cent, in 1914 it was converted into a decrease of 3.7 per cent, and in 1915 and 1916 to further decreases of 16.2 and 10.9 per cent, respectively. It is claimed that this improvement may be associated with the initiation in 1913 of the "Safety First" movement.—*The Engineer (London).*

A HANDY STAYBOLT CHUCK

A chuck for turning staybolts when applying in the fire box sheets which does away with the necessity of squaring the ends is shown below. The driver, which is made of tool steel, turns readily in the recess in the body of the chuck. It is held in place by the Knurled cap. The chuck is slipped over the head of the staybolt and the driver engages as soon as the motor turns. When the bolt has been screwed in the proper distance the chuck is disengaged by turning in the opposite direction for a short distance.

In operating the staybolt chuck it may be used most conveniently with a reversing motor, although it can be



Chuck for Turning Staybolts With Ends Not Squared

removed without difficulty when a non-reversing motor is used by turning backwards by hand about a quarter turn. The drawing shows two sizes, the recesses in the bodies of which are 1¾ in. and 2 in. in diameter, respectively. These have been found to have a wide enough range to take care of all the sizes of staybolts commonly used.

Machining Car Wheels and Axles

Benefits Derived by Greater Precision in This Work; Methods Followed by a Large Railroad Described

CONSIDERING the heavy character of the work done in machining car wheels and axles and the number of tons of metal handled per day, the short time taken to machine each wheel or axle and the fact that this work is performed in many small shops where expert supervision cannot be expected, the number of delays to train movements from defective workmanship on this part of the equipment is surprisingly small and speaks well for the conscientious care given this subject. Recent improvements in the performance of this class of work have been made possible by the use of recording pressure gages on wheel mounting presses that make a graphic record of the pressure at which wheels are pressed onto the axles, by more substantial lathes and boring machines and last, but not least, the use of micrometer calipers to check the work. This work appears crude to persons accustomed to machine manufacture. However, the work as performed in the average shop stands the test in actual running conditions and to go to greater refinements would only add to expense without compensating benefits.

A description of the method followed in one of the leading railway shops follows:

CAR AXLES

Car axles are generally turned on special center-drive double end axle lathes of heavy construction on which both ends of the axle are turned at the same time. A series of tests were conducted to ascertain the proper cutting speed and feeds best adapted for this work, for which purpose a variable speed motor was belted to the lathe. This test indicated that the best all around results can be obtained when running about 45 r. p. m. on the larger axles, such as 5-in. by 9-in. journals and feeding about 1/16 in. per turn. This gives a cutting speed between 80 and 90 ft. per minute on the 7-in. wheel seat. With good average high speed steel and a liberal supply of water or cutting compound applied to the point of the tool, the tool would hold its edge for several axles. Higher cutting speeds while possible with good steel had a tendency to cause the axle to chatter and were not recommended for practice. This comparatively high cutting speed and feed of about 1/16 in. per revolution produced a fairly smooth surface that would meet the requirements for wheel seats and also the journals were turned smooth enough for average burnishing.

Considerable controversy has been indulged in concerning slow cutting speeds and coarse feeds versus fast cutting speeds and fine feeds. With the average workman grinding and setting his tools, there is no question but that on the average a smoother job could be produced with the high speeds and fine feeds, and as a result the lathes were speeded up to about 45 r. p. m. An axle wheel seat turned with a 1/16-in. feed will permit re-mounting three or four times without re-turning the axle, whereas with a coarser feed and deeper humps and hollows, the humps are pushed off more when mounting and dismounting and call for more frequent turning.

After the turning operation, which is going on at each end of the axle at the same time, the journals are rolled or burnished. This operation is now quite common. The burnish wheel which is about 4 in. in diameter is made of carbon steel, hardened and carefully ground on the periphery and in the hole, one edge of the wheel being made convex to about 1/16 in. less in radius than the fillet on the axle. The other surface of the wheel is straight. This burnish wheel is mounted in a forked holder that is secured in tool posts, the burnish wheel revolving freely on a shaft passing through the fork. By pressing the burnish wheel against the axle and feeding the carriage back and forth, the journal becomes very smooth and a surface that gives satisfactory service is formed. Care must be taken to set the burnish wheel true with the axle to prevent rolling a shallow thread on the journal. The fillets are finished by feeding the carriage by hand so as to roll the entire fillet.

As a further refinement, journals are finished with emery cloth fitting in a soft wood block concaved to the radius of the journal. The wood block is forced against the journal by the tool post and is fed back and forth, the emery cloth being well oiled to prevent the emery lodging in the axle. Afterwards the journals are carefully wiped to remove all loose emery.

The method outlined above produces a very satisfactory journal. A simple test for determining the high and low spots on a journal is to lightly rub a new hand emery or oilstone lengthwise of the journal and note the marks on the surface. A truly turned or ground journal will show almost a continuous line from end to end. Poorer work produces only a few spots.

In order to insure good workmanship it is essential that all axles be properly measured or calipered, both to check the workman and to insure that lathes are in a proper state of repair. The micrometer caliper is now very extensively used for this purpose and where used has invariably raised the standard of workmanship, lessened failures and has become very popular with the workman, so much so that it would be difficult to make them go back to the machinist calipers for measuring the work. When turning wheel seats to fit wheels, or boring wheels to suit axles with calipers, the workman must set one set of calipers to another set and make allowance for the amount the axles should be larger than the wheel bore. This at best can only be an approximation and requires a man of considerable experience to insure proper dimensions and wheel fits. With the micrometer caliper the axle diameter and wheel bore can be measured exactly, so that the amount the axle is larger than the wheel bore is known to one or two thousandths of an inch. Practice has clearly demonstrated that measurements can be made more quickly by a micrometer than by machinists' calipers and all wheel shops making use of other than micrometer calipers should carefully consider their use. The question of educating men to their use at first appears a bugbear, but experience has shown that this was only a "bugbear" for the men soon come to prefer the micrometers.

It is good practice to measure each wheel seat at each end and in the middle with the micrometer calipers. A wheel seat should not vary in diameter more than .004 in. for use in cast iron wheels and less for steel wheels, a greater taper being liable to start a crack in the wheel or cause it to come loose. This may be obtained without delaying the output. When these micrometer measurements are taken, the average diameter should be chalked on the axle for the benefit of the workman mounting the wheels, as will be explained later. The above limit of .004 in. can readily be obtained with lathes in a fair state of repair. Unfortunately, the wear on axle lathes is large, especially on account of the burnish wheel which naturally throws a heavy strain on the shears of the lathe and causes them to wear over the space the carriage travels. This wear can to a certain extent be equalized by shifting the tailstock, thus making

the error the same at each end. A lathe on which wheel seats are turned at either end which has become so worn that a taper in excess of .004 in. is obtained throughout a cut should be repaired, as a greater taper is liable to cause a loose or cracked wheel.

Lathe centers should be kept in proper shape and should be ground to an angle of 60 deg. or to a standard center gage. It is essential that all railway shops maintain this angle. Car axles go from one road or shop to another for repairs and the general appearance of the centers in many axles indicates that the question of lathe centers has not been given enough attention. Unfortunately double end lathes have two dead centers, therefore, the centers cannot be ground in place by portable center grinders. Therefore, other methods should be followed such as grinding them in tool room grinders, etc. It should be remembered by all who turn axles that an axle being turned on poor, rough, or improper shaped lathe centers may ruin the centers in the axle and cause it to run out of true when being returned, thus making it necessary to turn off an excessive amount of metal to true it up.

WHEEL BORING

Wheels are generally bored on special wheel boring mills having massive chucks for the clamping wheels. The adjustable boring bar having a micrometer dial for setting the cutters to various diameters is now becoming quite popular and possesses many advantages. Where the ram travel will admit, double cutter bars are used, having one set of cutters near the end of the bar and the second set some seven or eight inches above. With the latter, the lower cutters are used for roughing and the upper cutters for finishing. By this method one set of cutters can be kept sharp for the finishing cut. It is generally the custom to insert a tool at the extreme upper end for slightly counterboring the wheel, which is helpful when mounting.

When axles have been measured with micrometers as described above, a memorandum is made of the axle wheel seat sizes and posted on the boring mill. The boring mill operator then bores the wheels a certain amount smaller than the diameter of the wheel seats. For steel wheels this averaging about .001 in. for each inch diameter and some .002 in. for cast iron wheels.

When rough boring, the cutters are set about .04 in. small by the micrometer dial on the bar for the average machine. For a mill in a good state of repair and where the bar is very rigid this can be reduced. It is essential, however, that the finishing cutters remove enough metal to true up all surfaces of the hole. After the roughing cut is taken, the finish cutters are set to the exact diameter required and the finish bore is taken, after which the hole is measured, and, if correct, the size is chalked on the wheel. When mounting a wheel on an axle the micrometer sizes chalked on the axle and the wheel indicate the wheel for each wheel seat. With fair adjustable boring bars having micrometer dials, an average workman will bore 90 per cent of the wheels to within .001 in. of the size called for.

The methods explained above have many advantages over the older methods where solid cutters were used in the boring bars and where it was necessary to turn each wheel seat to a certain diameter to fit the wheel bore. When turning new axles it requires a high grade workman to turn each wheel seat to an exact size, say to a limit of .001 in. It is more economical to turn axles to a limit of say .010 in. over or under size, as this can be done easily and a larger output will be obtained from the axle lathes. The wheels can then be bored to suit with the aid of the adjustable boring bars. The operation of setting the cutters in boring bars is confined to turning the setting screw and micrometer dial to the required figure.

For repaired axles it is essential that the smallest amount of metal be turned from the axle in order to prolong its life, the practice being to simply true up the axles without regard to size, and bore the wheels to suit. With the adjustable boring bar and micrometer measurements this can be done without any delay to the output. When considering the fact that the average axle can only be reduced in diameter about ¼ in. it is true economy not to turn away more metal than necessary. With axles at normal price, each .001 in. diameter is worth about four cents. Just now the cost is very much in excess of the above.

GRINDING AXLES

The question of grinding car axles has been discussed pro and con by makers of grinding machines and railway people and has gone so far that the Norton Grinding Company made a special grinding machine for this purpose. This machine employed a grinding wheel with an 8-in. face. This was fed directly onto the journal or wheel seat and had no lateral motion. Where the journal was longer than the face of the wheel, the grinding wheel was shifted by a hand control wheel, similar to the usual plan on grinding machines. The wheel was then fed in a second time and the axle ground until the second cut was equal to the first. This could be readily ascertained by sparks being thrown from the surface previously ground. On the completed surface it was impossible to detect the line between the two surfaces ground. The fillet was provided for by rounding the corner of the grinding wheel to the same radius as the fillet. This was done by a radius turning diamond holder and was made in a very short time. It would appear difficult to maintain a true surface on a grinding wheel having an 8-in. face; however, with the modern grinding wheel methods of manufacture, it was found that the face would remain true for several axles and that the time required to true wheel with a diamond was not a serious consideration.

The future of the grinding machine for car axles is hard to predict. Without a doubt the average work turned out is better than by present methods. But the present methods appear to meet the requirements. For new axles it is not practical to grind to the finish size without previous turning to about 1/32 in. above size. This will require the axles being handled twice. For repaired axles, grinding apparently has the advantage that a smaller amount of metal will be removed from the axle. This may result in a saving that will make grinding very attractive.

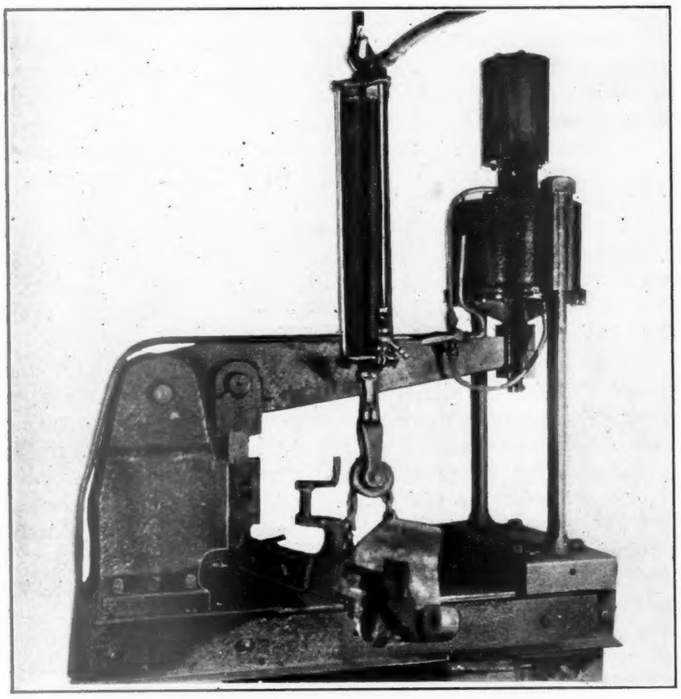
EXPLODED REAMER

Engineering of London in its June 22 issue prints an interesting letter from Conrad F. Mendham regarding the explosion of a 12-in. reamer of 1.840 in. diameter. The reamer was made for a special job and very carefully finished, but was found to be a trifle too small in boring its first and only hole. It was then repacked in the original oil paper, brown paper and corrugated strawboard in which it was received and placed in an empty drawer. Three weeks later the drawer was opened and the reamer was found in two pieces, lying about 3 ft. apart. A small third piece was found inside the package. Both the brown and oiled paper were badly torn and in the case of the latter a large portion was reduced to pieces about ¼-in. square. The steel was of good quality and the fracture shows a clean, new, honest break, resembling the feather figure usually seen in ice blocks. The area of the fracture was 24 sq. in. Mr. Mendham states, "Without taking into consideration the greatly increased tensile strength due to hardening, the internal stresses tending to burst the bar may easily have been over 1,000 tons. It is curious that this tool, made for boring out mold shapes for forming up high explosive material, should have itself exploded before doing any useful work."

PNEUMATIC SHEARING MACHINE

BY E. A. MURRAY
Master Mechanic, Chesapeake & Ohio, Clifton Forge, Va.

The device for shearing coupler yoke rivets shown in the illustration can be made at slight expense and enables the

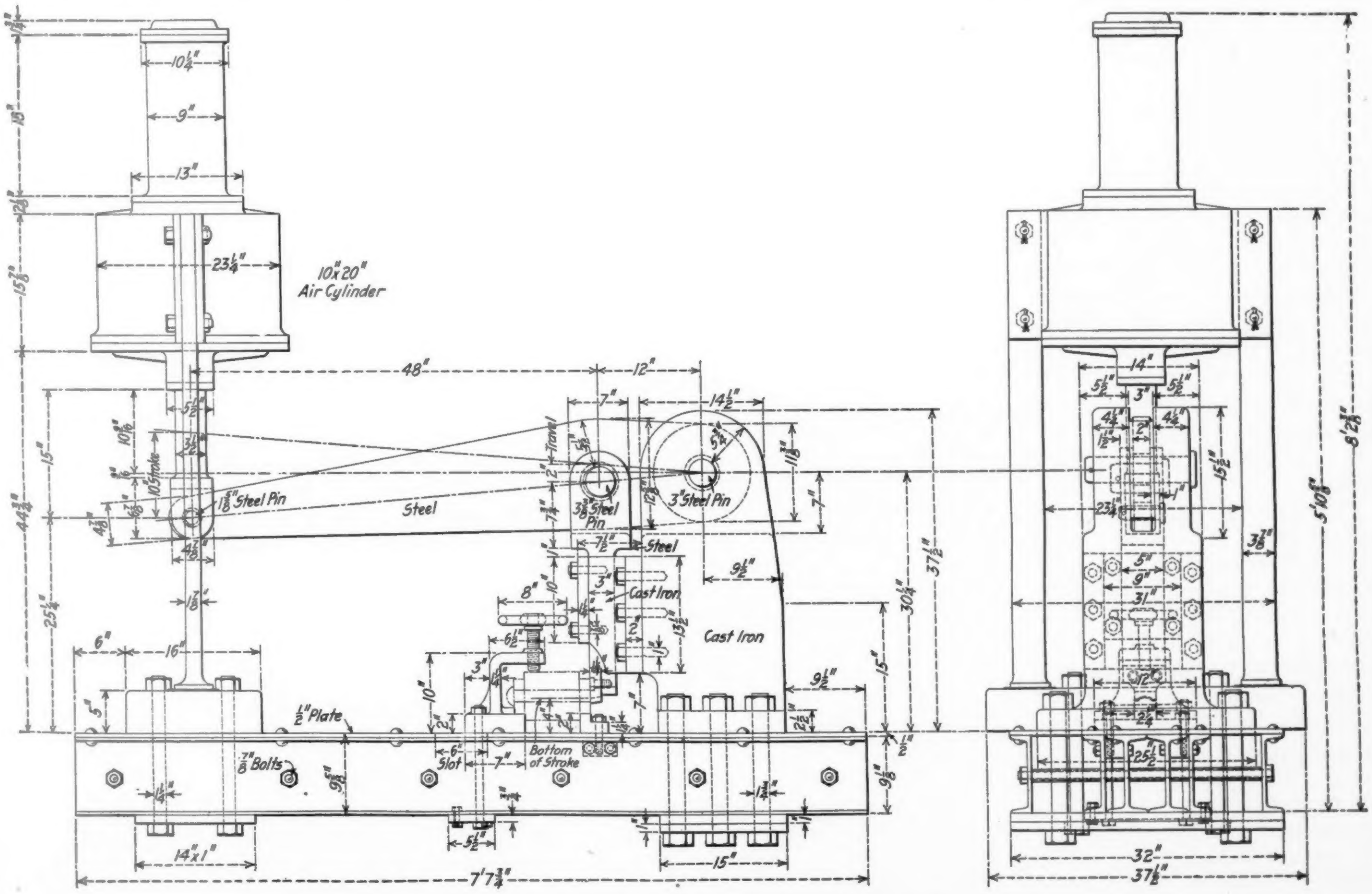


Pneumatic Shearing Machine for Coupler Yokes

yoke rivets to be cut at any point where compressed air is available. The saving effected by eliminating the necessity of carrying coupler yokes to the shear is quite considerable. The base of the machine consists of two 9-in. I-beams and four 9-in. channels to which are riveted two ½-in. steel plates. At one end of this frame is placed a yoke which carries two air cylinders, the upper one of which serves as a dash pot. The lower one is 20 in. in diameter and the upper 7¾ in. At the other end of the frame is bolted a heavy casting which serves as a fulcrum for the steel arm which carries the shear and shear blade. Directly under the shear blade is bolted a block which serves as a support for the coupler yoke when the rivets are being cut, the other side of the yoke being held up at the same time by a movable bracket to which is attached a handwheel, which is attached to a screw. By tightening this screw after the coupler is in position, it is impossible for the coupler to turn when the shear blade comes down upon it. The arm to which the shear blade is attached is of steel. It has a travel of 2 in. and is guided by a slotted casting, bolted to the fulcrum casting. The lever, which is attached to the cylinder is of steel, the proportions being such that a leverage of five to one is obtained on the shear. A lateral movement for the pins in the piston rod and the shear arm is provided for by slotting the holes in the lever. The air to the machine is controlled by the 3-way valve shown just below the large cylinder and at the left.

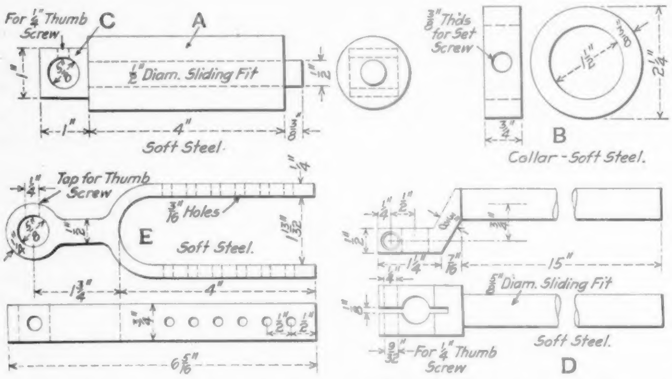
CUTTING HOLES IN SIDE RODS WITH OXY-ACETYLENE

A device for cutting out the holes for the crank-pin bushings in side rods is being used with success at the Silvis shops of the C. R. I. & P. A sketch of the parts is shown below. In using the device the hole for the bushings is first laid out in the usual way. A one and one-half inch hole is then drilled in the center and a three-fourths inch hole with the center five-eighths inch in from the edge. The



Elevation and End View of the Pneumatic Shearing Machine

bushing shown in the illustration at *A* is placed in the hole, being held in position by the collar *B*, secured by a set-screw. The swivel *C* is then slipped inot the bushing *A* and the guide *D* is placed through the hole in *C* with the offset downward, and held in position by the set-screw in *C*. The fork *E* is placed on the end of the guide, extending upwards. The torch is set in position with the tip extending downward through the hole in the end of the guide, and



Device for Grinding an Oxy-Acetylene Torch When Cutting on a Circle

clamped by a thumbscrew. The handle is supported by a pin placed through a hole in the fork *E*.

The guide is adjusted to cut about three-eighths inch inside the marked line, and the cut is started at the three-fourths inch hole. The holes are finished as is usual on the horizontal boring machine. This device has been found to save considerable time as compared with the method of boring the holes on a drill press.

AND THEN THE WORM TURNED

BY HARVEY DEWITT WOLCOMB

"And finally," continued the young man, "you recognize the fact that when you buy any piece of material from a private firm, you certainly must pay them a profit on the article. But with my system, I propose to save that profit for your company by manufacturing right in your own shops. No doubt, you have some machines at the various shops on your road which can be spared, in fact, I feel there are some machines which are not in use at all, and by moving this machinery to some one point, you have the beginning of a manufacturing plant which means the saving of thousands of dollars to your company. By manufacturing yourself, you save the delay in purchasing in the open market, you save the profit made by the private concerns, and you place your production on a basis where your own shop management is responsible for the output. They can handle the supervision of the plant at no added cost to you, and the only increased cost of which you would be aware is my salary."

The general manager looked at the young man who sat opposite him in his office, with a look of admiration for the very able manner in which he had just presented his case. The G. M. was known from one end of the road to the other as a "war horse" of the old school, and it was understood that any one who could slip anything by the "Old Man" was certainly pretty slick. He was raised in the school of railroading where the man who held the important and dignified position of general manager was looked upon as almost equal to the Supreme Being. When any man entered his august presence it was with a very profound feeling of his own insignificance; thus all the "Old Man" had to do was to roar and the subject in his presence either swallowed his tongue or had a case of heart failure, and there was no further argument. But here was a young man who apparently knew what he was talking about, for he had his facts and figures all arranged to a nicety, and did not hesitate at any of the questions the "Old Man" fired at him, so he must certainly be able to deliver the goods. The arguments he presented were very plausible and convincing, and for once the "Old Man" was nearly caught. As he turned the matter over in his mind, however, he began to wonder why his own mechanical officers had never proposed such a plan. He felt that his mechanical department included some of the brightest men in the field, and in the past they had always seemed to be up to date—in fact, had made several records in economical management which he had been justly proud of. There must be a loophole somewhere, and he decided not to take any action without first giving his own men a chance.

Turning to the young man who had been patiently waiting his decision, the G. M. said that while the plan just presented looked very good, it would be necessary to look into the matter very carefully before signing a contract, and thus closed the conference.

Thus was laid the foundation for the "turning of the worm." As is usually the case, John Gillen, machine shop foreman at Grants, the largest shop on the system, was one of those overworked, underpaid mechanics, who are really responsible for the good, everyday records in shop production, but for whom very little consideration is ever shown.

Shortly after the above conference was held, the general foreman asked Gillen one day how much he could save if he had some more machines. Instantly, John had visions of at last receiving the few new machines for which he had been plugging for the last three years, and mentally began to rearrange his shop to receive them, and to select the work he would assign to them. His vision was soon shattered when the general foreman told him of the plan of which he had just heard. "Somebody has been stuffing the 'Old Man' on the manufacturing idea," said the general foreman, "and he has about made up his mind to try the scheme at this shop by gathering up all the old cast-off machines along the line and putting them in the right wing of your machine shop so that you can look after the work."

"Don't fool yourself about anybody stuffing the G. M." said Gillen, "he knows better than to try any idea like that. Didn't he tell you himself that for any railroad to run their own foundry was a waste of money, and isn't that just as much a manufacturing proposition as making up parts in our machine shop? I suppose some 'bug' has discovered that we are not efficient and wants to practice on us. Now, if you really want to save some money for this company, just make up a requisition for that new radial drill and those two planers I need, and I will show you how to save on our every-day jobs. Why, I haven't a single tool in the shop that has been built since we adopted high-speed tool steel."

"Yes, I know," quickly replied the general foreman, who knew what to expect when Gillen got started on his hard luck story about the kind of machine tools he had to get along with. So he beat a hasty retreat while the way was yet open.

Now, under a gruff exterior, the general manager always respected and appreciated true loyalty on the part of his employees, and he had often been much annoyed and not a little hurt, when approaching an employee whom he knew to be a good man, to have him slip through a door or around an engine in order not to have to pass him. Whenever he visited Grants shops, he always liked to go over the place alone in the morning, before the day's work had begun.

Not long after the idea of establishing a manufacturing department had been suggested to the general manager he came face to face with John Gillen, while making one of his early morning visits to the Grants shops. Much to his surprise John did not try to dodge him, but came straight

up to him as if he intended to start the conversation. In the past the general manager always had literally to corner John before he could hold him long enough to get anything out of him. "Mr. Allen," began John, "I have been working for you a good many years, and have never had any reason to think that I have not made good, and yet, every time I want simply to move a machine the matter has to be taken up before a committee, none of whom knows as much about what I need as I do. I am the man on the ground all the time and can study my conditions better than some one who comes here only occasionally. A person speaks with authority because of his ability. His ability is recognized because of his records, and I guess I have been with you long enough to establish records to prove my value to your company. The other day I made a request to turn a lathe to a slightly different angle because the light shone on the workman's eyes. I simply wanted to move the machine a little to improve conditions for the operator, and in turn increase the amount of work he could turn out. But what happened? The committee came over to investigate the need of the change, and because it happened to be a cloudy day they turned my request down as unnecessary. The reports which I make deal with conditions, not theories, and I only want a chance to prove to you that the best investments are made on knowledge acquired by thorough experience.

"And I don't get any better results when I ask for the new machine tools, which we need so badly at Grants. How long would you keep your train despatchers if they put one of our big 'hogs' on a two-car train, and then expected one of our little eight-wheelers to haul a long, heavy freight train over the road? That is just what I have to do every day here in our machine shop. I use old, antiquated machinery, which was built before some of our locomotives were; in many cases I have to handle a small job on some big awkward machine, simply because I haven't any machine of the right size to use. You have purchased heavier locomotives and immediately arranged to lay heavier steel and strengthen bridges on which to run these big engines, but here in the shop, you have given us more powerful tool steel and expect us to get out the full amount of work it is capable of doing by using it in the same old light machines. You wouldn't place one of these old boilers, such as were built 20 years ago, on a modern locomotive, because it couldn't make enough steam, yet you expect us to keep up with our work, which is always growing heavier and larger in amount with our old equipment.

"Well, John," replied the G. M., for once in his life at a loss for an argument with which to silence Gillen effectively, "just what do you want?"

Although Gillen was so nervous that his knees were shaking, he came right back at the G. M.

"To begin with," he replied, "I want a planer that will take a cut at least one and one-half inches deep with a one-eight inch feed, and will wade right through the cut without a whimper. We have one planer here that will stand all we can give it, but I have so much work for it that it never gets a chance to breathe. We need new lathes, a new drill press and some grinders." John got so wrapped up in his pet subject that he forgot himself entirely and asked for enough machines to equip his entire shop. Finally, he reached the point where he was unable to think of anything he had left unprovided for, and stopped for breath.

"Now, see here," replied the G. M., "one trouble with you fellows is that when you ask for anything, you ask for so much that you are way out of reason. I feel confident you need some new machines, yet from your own account I am unable to say just how many. But I am going to leave the matter entirely in your hands, and I want you to go over the ground carefully, make up a list of just what you need and I will arrange with your master mechanic to order what you say is actually required."

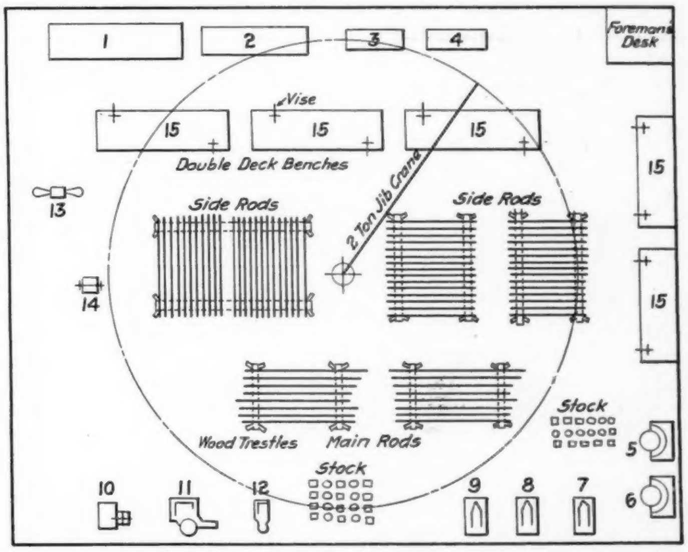
"Remember," continued the G. M., "this is a matter entirely between you and me. I will answer for any request you may care to make, and I am depending on you to be absolutely fair in what you ask for. While the railroad would like to give you an entire new plant here, you want to remember there are other fellows who are probably just as bad off as you are. Don't forget to say just what make of machine you want, for I intend to see you through this deal, if it is the last thing I do." Before John could say another word, the G. M. moved off, leaving him to wake up to a realization that the G. M. was human, after all, and open to a reasonable business proposition from one of his own men.

Shortly after this, as the general manager O. K.'d a special requisition for machine tools, he could not help but recall his conversation with Gillen; and to identify this one requisition, should any question ever arise as to why the road should purchase a new planer, a new radial drill and two new lathes, he wrote up in one corner: "And then the worm turned."

REPAIRING MAIN AND SIDE RODS*

The operations in repairing rods are much less complicated than manufacturing new ones. First, it is necessary to mark and check them according to the number of the engine, clean each of them thoroughly, dismantle, straighten, re-fit, renew such parts as cannot be repaired and re-tram. Such as are not in accord with the original cards are altered to conform thereto.

Repairing is one branch of the business and manufacturing new rods is altogether another. A gang brought up



Arrangement of Machine Tools for Handling Rods for a Shop Output of Eight to Ten Locomotives per Week

LIST OF TOOLS

1—Lathe—28 inches by 8 feet	9—Shaper—24 inches
2—Lathe—18 inches by 6 feet	10—Power Press—25 tons
3—Lathe—18 inches by 6 feet	11—Radial Drill—5 feet
4—Lathe	12—Radial Drill—42 inches Upright
5—Vertical Turret—30 inches	13—Grinder—Swing
6—Vertical Turret—34 inches	14—Grinder—dry
7—Shaper—24 inches	15—5 Benches
8—Shaper—24 inches	

on repairs only may in time become as proficient as the gang handling new work, but rarely can this be reversed. The various ways for handling repair and new work are also different. Men accustomed to do nothing but new work seldom, if ever, became expert at repairing. It calls for a different variety of resourcefulness.

The size of a rod corner depends upon the number of

* This article was received with no letter of transmittal from the author. We shall be glad to learn from whom it was sent.—EDITOR.

locomotives to be cared for. Good men and a few stout, well-designed tools can accomplish a vast amount in this department. The description which follows is for a shop capable of handling for general repairs eight to ten engines per week in connection with the building of one new engine per week.

An essential requirement in any modern shop and especially a rod corner, is an overhead crane. It is possible to get on without it, but very inconvenient. Handling heavy material is awkward and dangerous. When done by hand, it often results in permanently maiming some employee. In planning this department some attention should be given to the movements of material so as to have it make as few moves as possible. All movements should be forward so that the rods will advance step by step towards the final spot to which they have been assigned. The machines necessary for repairing rods are lathes, shapers, heavy and light drills, vertical turret mills, power press, grinders and benches. Good, strong vises and a full equipment of small tools should also be provided, especially air drills, hammers, jacks and chippers. The illustration shows the arrangement of machine tools in the rod corner, the size and list of the tools being shown below it. In addition to these tools, the following tools not located in the rod corner proper are used a portion of the time for new rod work and for repairing old rods:

30-in. by 30-in. by 10-ft. planer	60-in. vertical milling machine
32-in. by 38-in. by 10-ft. planer	38-in by 38-in. horizontal milling machine
18-in. slotter	50-in. horizontal boring mill

A rod corner properly laid out and equipped should be able to take care of every detail in connection with the manufacture and repair of rods after the heaviest machine work, such as milling, sawing and slotting, has been done in the main shop. Few, if any, railroad shops have independent rod departments such as the large locomotive builders have. It would mean a big outlay of money and much idle machinery. The average shop must of necessity plan for its machinery so as to be of general use. A row of solidly constructed wooden top tables, about 30 in. high, makes a most serviceable and convenient fitting up bench. They should have large, strong drawers with locks and a lower deck for storing bolts, clamps and rigging of all kinds for doing the regular and special jobs and to keep such work off the floor. The placing of the machines as shown in the illustration is so that the fitters may be served from one side with the heavy parts such as bushings, bearings and straps, and from the lathes on the other side with pins, knuckle washers, keys, bolts and all small parts.

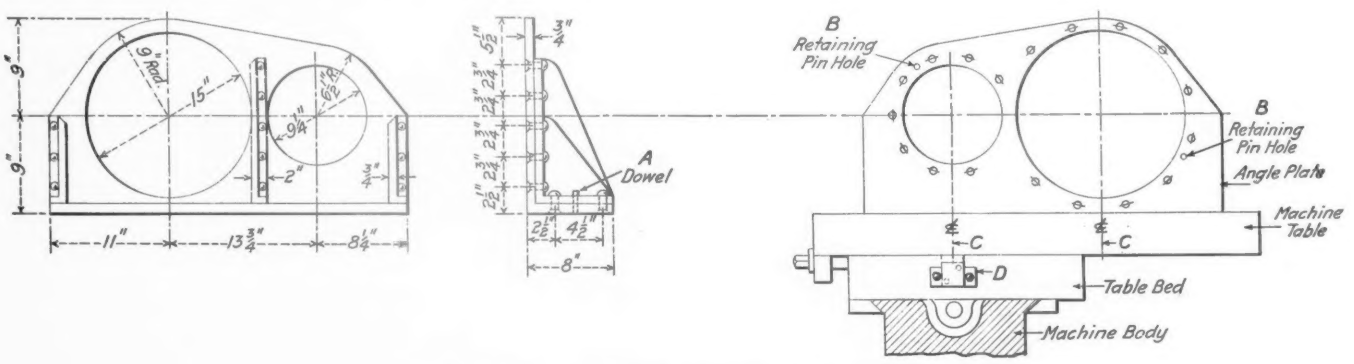
A post gib crane with sufficient lengths of boom to swing clear and sweep the entire floor space, handles everything within a radius of 20 ft., approximating 1,200 sq. ft. of floor space. On this boom there should be a hoist of 1½ to 2 tons capacity. It may be operated by power, but a triplex geared hand power block will serve very satisfactorily, though not quite so quick in its movements. Not many rod corners are adaptable to such a crane as this but where there is sufficient clearance no better arrangement can be designed and none can surpass it for general all-around usefulness. It will easily supplant several husky helpers. The heaviest main rod may be easily handled by one man and with less liability of accident than if it were handled by laborers. The swinging grinder is also useful, as it has a broad sweep and flexible construction, so that nearly every condition may be met. Bushings for knuckle pins and rod connections are made from special steel pipe, bored, turned to size, hardened and then pressed into place. This is a very simple and inexpensive practice, which allows the original holes to be maintained always to standard sizes. This department should be planned with special reference to daylight. If artificial light must be used, have it in abundance. Nothing is more exasperating to the ambitious mechanic than to struggle with darkness while trying to do a good job and a full day's work. Many a rough job is made rougher due to poor lighting facilities.

One very important point in the design of locomotive main and side rods is to keep the number of shapes to the minimum. Milling cutters are expensive tools to manufacture and maintain, so also are taps and reamers. By neglecting this, it is astonishing how these tools and templates may multiply, while with the exercise of a little skill in designing, these details may be reduced to a comparative few. Rod radii, for example, in a majority of cases may be made to conform to the nearest stock milling cutter, likewise cutters for fluted sections and the adoption of a standard taper for knuckle pins, bolts, keys, will require but few tools of this nature. Interchangeability will count for much here and effect a considerable saving in a short time. When there is no real object to be gained, rods should be kept the same length center to center—it will help to reduce the variety of billet sizes—and in emergency they may be transferred from one engine to another of the same general class and size. The length of rod center should always be in even dimensions—omitting fractional parts of an inch.

JIG FOR REBORING COMPOUND AIR COMPRESSOR CYLINDERS

BY EDWIN F. GLASS

The sketch below shows the details of an angle plate made from ¾-in. boiler steel used for reboring the cylinders for locomotive air compressors of the 8½-in. cross compound type on a horizontal boring machine. This angle plate is bolted to the table of the machine, and is held in place by two dowel pins, shown at *A*. The cylinder to be rebored is bolted to the face of the angle plate, and is brought to the correct position for boring each time it is applied to the angle plate by having the retaining pins in the ends



Jig for Reboring Compound Air Compressor Cylinders

of the cylinders fit into holes in the angle plate, shown at *B*. Two center lines are scribed and marked with a center punch on the side of the machine table, as shown at *C*. These lines are 13¾ in. apart, the exact distance between the centers of the cylinders, and are drawn in an exact line with the center of the cylinders.

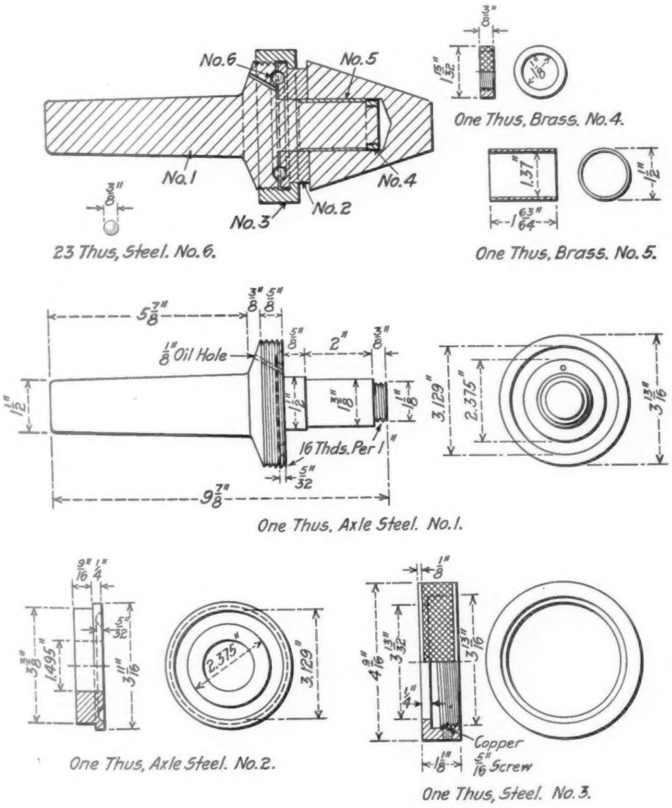
The table bed is fitted with an iron block, shown at *D*, which is bolted to the table bed with two ⅜-in. bolts, and held in place by two dowel pins. At the top of this block there is a zero mark, and when the table of the machine is drawn to the center of the cylinder, the line on the block registers correctly with the line on the table. In laying off the holes in the angle plate to correspond with those in the cylinder, care should be taken that the lug or bracket on the back of the cylinders is about ⅛ in. above the face of the machine table, this is to allow for irregularity in measurements from the center of the cylinder to the face of the bracket.

This device can be constructed at a small cost, and it will be found to save time in doing the work and give more accurate results. The principal advantage of this device is that the cylinders are always bored true with the face, and that the distance from center to center of the cylinders is also maintained. There is no necessity for resetting after reboring one cylinder; simply draw the table to the other center line and change the heads on the boring bar. When setting up a cylinder, line up under the brackets on the cylinder and place a clamp on each end. This will hold the work more rigidly.

BALL BEARING PIPE CENTER

BY E. A. M.

A ball bearing pipe center, which has been found very useful where it is necessary to turn or thread pipes on a lathe, is shown with its details in the illustration. It consists of a body *1*, the shank of which is tapered to suit the tailstock of a lathe. It is made of axle steel and has a finished length of 9⅞ in. and a diameter of 3 13/16 in. at the largest portion. A ball race is cut as indicated for 23 steel balls. The ball cup *2*, is also made of axle steel, being provided with a flange over which the retaining ring *3* is applied. This ring screws on to the large diameter of the body. When once the ring is adjusted it is held in position by a set screw, a piece of copper being applied at the end of the set screw to prevent damaging the threads on the body.



Ball Bearing Pipe Center

The outer end of the body is turned to 1⅜ in. diameter. Over this is placed the brass bushing *5* which has a sliding fit on the body and revolves on it. It is held in place by a knurled brass nut *4*, 1/64-in. play being allowed between the nut and the bushing. The tapered center on which the pipe rests fits over the bushing and revolves with it and the ball bearing cup *2*.

The ball bearing feature of this pipe center is especially interesting and has given very satisfactory results and the closeness with which the adjustments may be made, permits an accurate center being obtained. The small passage in the body of the center leading to the ball race is for proper lubrication.

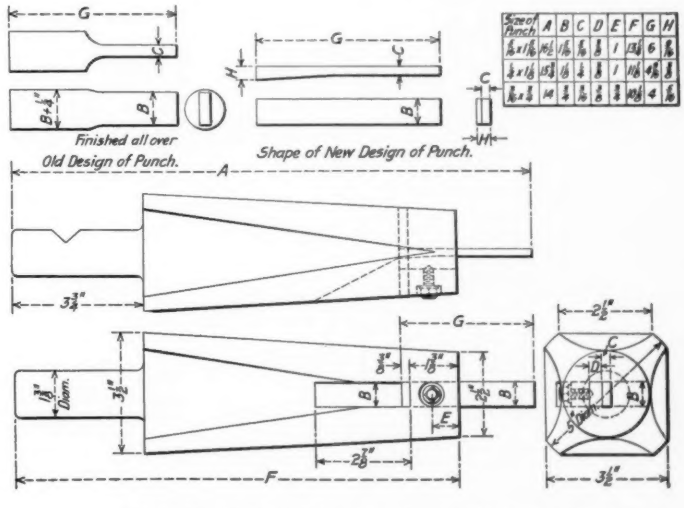
FLAT PUNCH FOR AJAX BOLT MACHINE

BY C. W. SCHANE

A punch for forming flat keyway holes in brake pins and spring equalizers, which effects a material saving in the amount of tool steel used and in the cost of the punch, has been developed for use with the Ajax bolt machine and is shown in the drawing. The punches formerly used, which are the type furnished with the machine, cost not less than 75 cents each, there being a considerable amount of machine work in finishing them for service as well as a waste of tool steel.

The new punches are drop forged in a special die under the steam hammer, scrap pieces of tool steel being used. All the labor which is required to fit the punches is to grind off the burr left by the forging, the pieces then being ready to temper. The cost of manufacturing the punches will not exceed eight cents apiece. The method of inserting and holding the punch in place will be seen clearly by an inspection of the drawing.

In manufacturing the punches originally used, the steel is first cut to length and then annealed for machining. It is then centered and turned in a lathe, after which the sides and edges are milled to the proper dimensions. The milling operation reduces the material from a body ¾ in. in



Flat Punch Designed to Save Tool Steel

diameter to blades measuring 3/16 in. by ¾ in. thick for the smaller size and in proportion for the larger sizes.

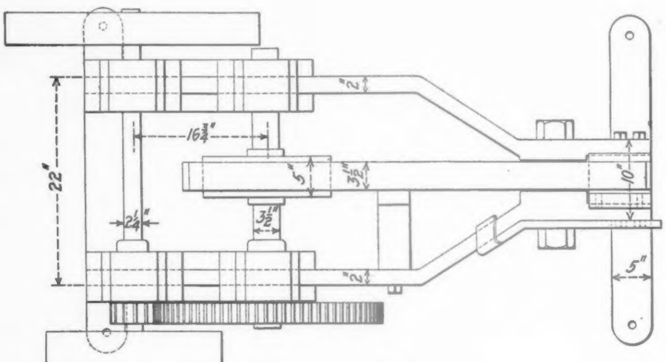
ALLIGATOR POWER SHEARS

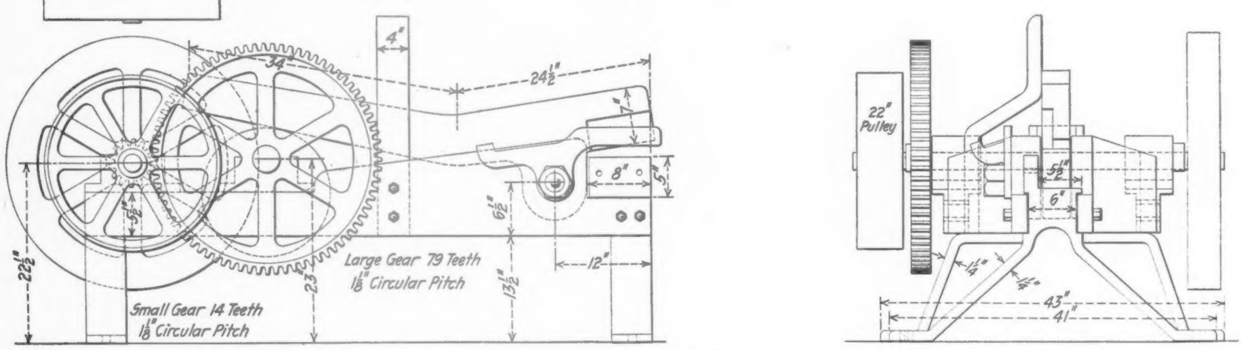
BY J. H. CHANCY
Foreman Blacksmith Shop, Georgia Railroad, Augusta, Ga.

The drawings show a home made power shear which was built in the Augusta shops of the Georgia Railroad to replace an old pneumatic shear, by the use of which a great increase in the capacity for cutting up material has been effected. The capacity of the machine ranges up to 2-in. round and ¾-in. by 4½-in. rectangular sections.

The machine was built at the shops at a total cost not exceeding $300. The frame was made from heavy iron beams of 2-in. by 12-in. section which were available and some of the parts were designed especially for this machine. As will be seen by an inspection of the drawings, the movable shear plate is operated by a cam on a 3½-in. shaft.

While, no doubt, a machine could have been purchased in the market which would possess some advantages over the one described, the service which this machine is rendering is entirely satisfactory and its construction was taken care of without interfering with the regular work of the shop.





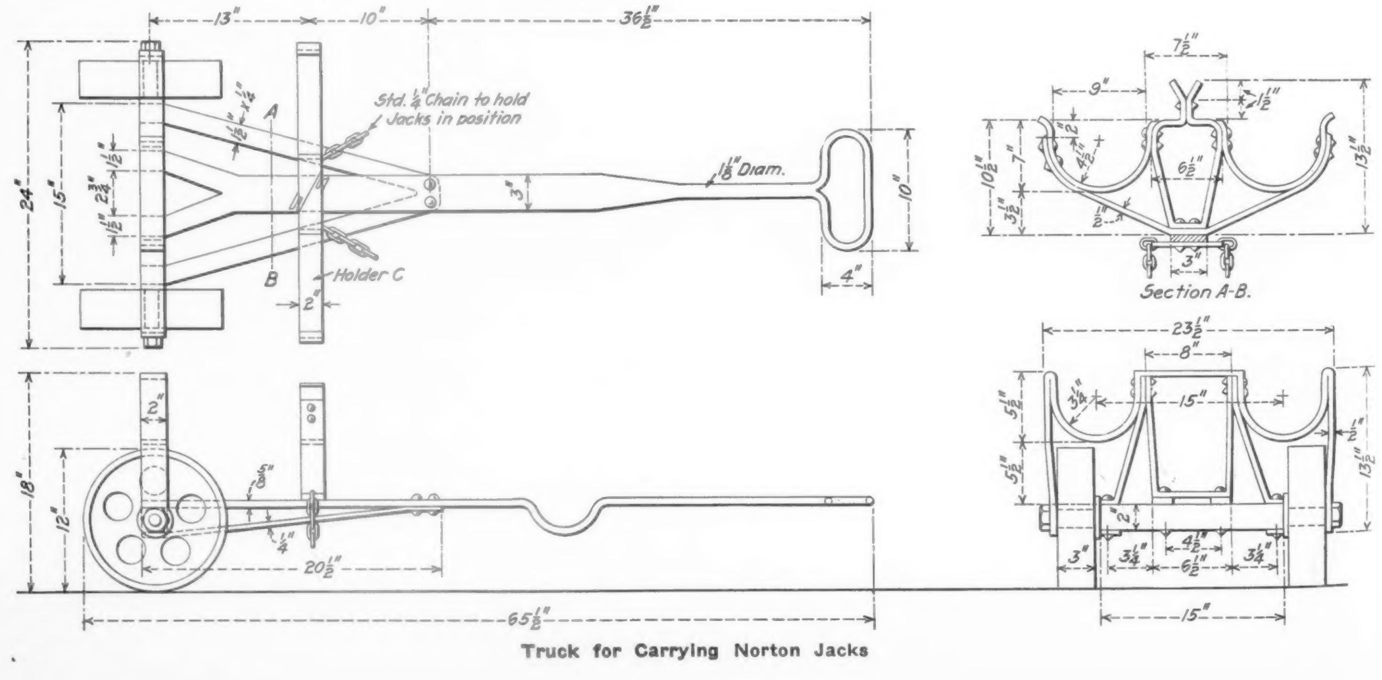
A Simple Shop Made Power Shear

NORTON JACK TRUCK

BY CHARLES W. SCHANE

A truck that is used by the truck and spring rigger men to handle two Norton jacks in and about a roundhouse or car yard is shown in the illustration. The work of these men generally requires the use of two jacks and by handling them in this way considerable time is saved, as they are always ready to be carried directly to the work. The truck is so designed that the jacks may be chained to it, and where the jacks are assigned to special workmen they are locked to the truck and held for their particular use. The device may be handled by one man.

The illustration shows clearly the construction of the truck. It is made up principally of bar iron, the tongue being ⅝ in. thick and 3 in. wide. The braces extending from the tongue to the axle are 1½ in. wide by ¼ in. thick. The yokes which support the jack are made of ½-in. material, 2 in. wide. The axles are made from a 3-in. square bar, and are 26 in. long, over all. The journals for the 12-in. cast iron wheels are 1¾ in. by 3¼ in.



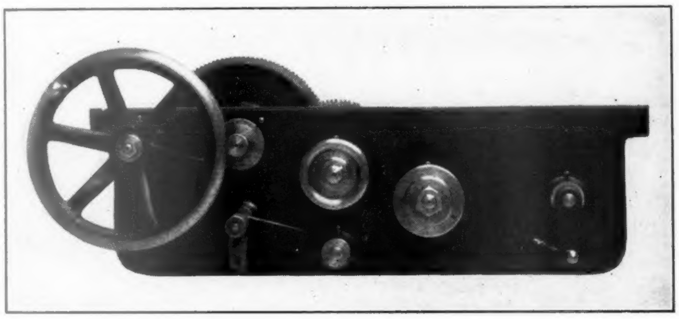
Truck for Carrying Norton Jacks

NEW DEVICES

APRON FOR HEAVY DUTY LATHES

The apron is the most complicated part of the feed mechanism of a lathe and in the apron the greatest strains are encountered. In an ideally designed lathe, the apron should be strong enough to force the carriage along the guides at any rate of feed and depth of cut which the headstock will pull and yet in the apron the greatest number of limitations and restrictions are imposed upon the design.

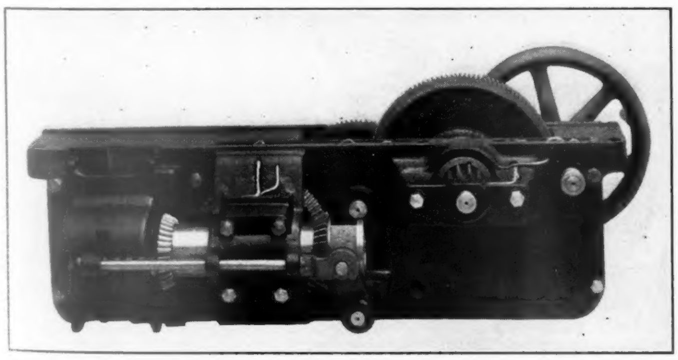
The apron shown in the photographs has been designed



Front of the Lathe Apron

by the Houston, Stanwood & Gamble Company, Cincinnati, Ohio, and with slight modifications, depending upon the size of the machine, is being used on all of this company's standard engine lathes, varying in sizes from 30 in. to 60 in. inclusive. The design of this apron includes a number of features which give it unusual driving power, structural strength and durability.

The gears are of steel without exception, this material



Back of the Apron, Showing Rack Pinion with Outer Bearing Support

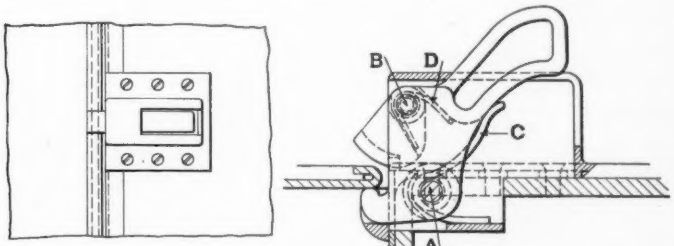
having been used in order that these parts may be able to stand up under the sudden and unusual strains imposed by unduly heavy cuts or other accidents not infrequently met with. Friction clutches have long been a source of annoyance because of their tendency to slip on the one hand and because of the difficulty of releasing them on the other. In this design the friction clutch has been replaced by the positive toothed clutch, the disks in the initial drive being connected by a shearing pin. This type of clutch, of course, does not slip and because of the slight pressure required to hold the clutch closed, it is very easily released. The shearing pin provides a weak point which protects the feed mechanism from damage should the carriage be accidentally fed against the tailstock, headstock, steady rest, or any other obstruction. The clutch for the cross feed is attached to the carriage and is not shown. However, this is a positive toothed clutch, similar to that in the initial drive.

By referring to the photograph showing the back side of the apron, the broad face and coarse pitch of the rack pinion will be noted. This pinion and shaft are so arranged that it may be withdrawn from the rack for thread cutting. One of the especially noteworthy features of the design, is the provision of an outer bearing for the rack pinion, which is usually overhanging. The large bevel gear in the initial drive is also provided with an outer bearing, but this is not shown in the illustration.

The bearings in the rear of the apron are oiled by means of a capillary wick system which can be seen in the photograph. The reverse lever for shifting the double bevel gear is of the usual type and it will be seen that the nut for the lead screw is opened and closed in the usual manner.

VESTIBULE TRAP DOOR LOCK

In the June 14, 1916, issue of the *Daily Railway Age Gazette,* was published a description of the Universal trap door which was manufactured by the Transportation Utilities Company, in connection with which was shown a special type of door latch and wedge lifter. A new type of door



Foot-Operated Trap Door Latch Which Insures the Opening of the Door

latch, which performs the same functions of latch and lifter, has recently been developed, for use with this and the National trap door, by the Tuco Products Corporation, New York, successors to the Transportation Utilities Company. This latch is much simpler than the one previously described, being foot operated and self contained.

By referring to the drawing it will be seen that the moving parts consist of the foot release lever, the latch and two springs. The release lever, which is pivoted at *A,* contains

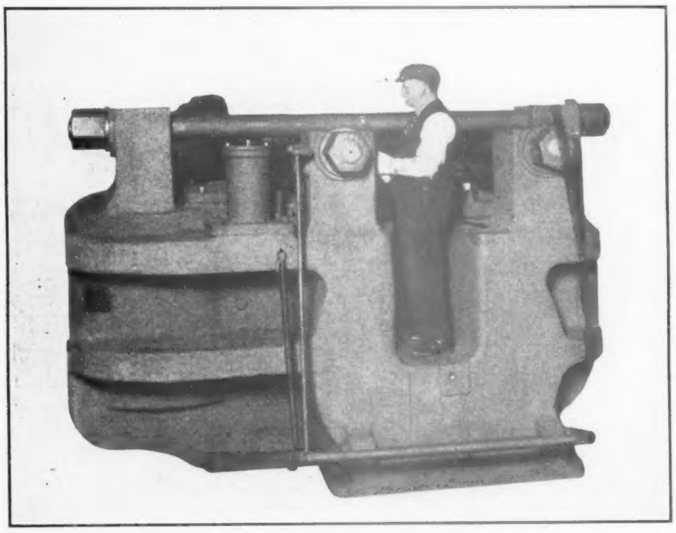
the latch and latch spring *D*. The latch is pivoted at *B* and when the trap door is closed, is forced back to permit the door to pass, against the tension of the latch spring. As soon as the door closes, the spring again forces the latch out to the position shown in the drawing. In opening the door, the latch itself is not moved. By stepping on the foot lever it is forced down against the tension of spring *C*, carrying back the latch with it, the whole moving about the pivot *A*. As the upper end of the lever is forced down by the foot, the lower end of the lever, which extends under the edge of the trap door, moves up, thereby starting the door. This serves to insure ready operation of the door, should it become frozen or stick from any other cause.

The design of the foot lever is such that no special care is required in its operation as a downward pressure exerted on it with the foot, no matter at what angle it may be applied, serves to operate it. The operator is thus enabled to so place himself that his leg will not be struck by the edge of the door as it swings up.

NEW AJAX FORGING MACHINE

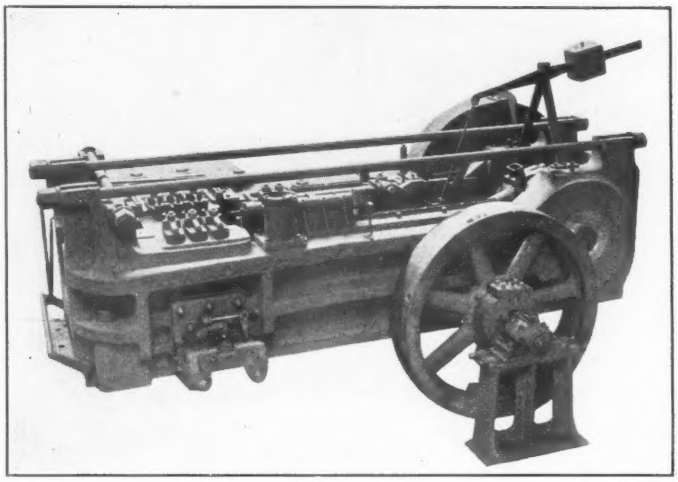
Large forging machines have found use on railroads for the economical production of heavy parts such as drawbars, side rods and eccentric cranks. Machines of more than 6-in. capacity have not been available for this work, although special machines of larger size have been built. To meet the demand for large forging machines the Ajax Manufacturing Company, Cleveland, Ohio, has put on the market a 7-in. forging machine. This machine is the heaviest and largest forging machine ever built.

The first 7-in. forging machine was built in 1911 and since that time a number of special machines have been constructed. These had a single toggle operating the movable die, while the present design has a double toggle. The standard machine is also heavier than the earlier design. The complete machine with its regular equipment weighs nearly 100 tons. The bed plate casting is of steel 21 ft. long and 9 ft. 6 in. wide and weighs about 60 tons.



Front View of the Ajax 7-In. Forging Machine

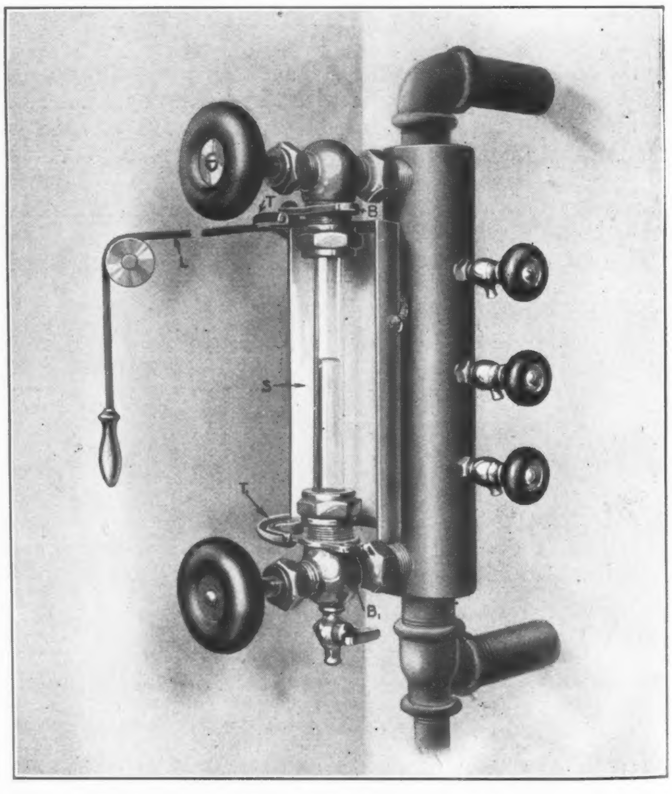
The 7-in. machine is built along the lines of the smaller Ajax up-setting machines. The crank shaft housings are continuous, being bored large enough to take the throw of the crank. The bronze bushed bearings are pressed into the bed from each side forming solid bearings for the crank shaft. The clutch mechanism is located between the main slide and pitman, and in this way the momentum of the crank shaft and pitman are utilized. As the clutch can only pick up the main slide and start it in motion at the end of a stroke, the action is very easy and a minimum of power is used in starting the machine in motion. The side motion of the moving die is operated through a set of knuckles from the main slide in such a way that the dies are closed when the heading tool is about half way forward and remains closed until the heading tool is back to the same point. This insures the heading tool being free from the forging before the grip is released. Liners may be used in the die seat to accommodate smaller blocks when light work is being done on the machine.



Ajax 7-In. Forging Machine

WATER GAGE GLASS GUARD

The Simplex Safety Boiler Gage Glass Company, Myrick building, Springfield, Mass., has recently placed on the market a gage glass guard, the purpose of which is to protect the workman when shutting off the gage glass valves when a glass has become broken. It consists of a semi-circular

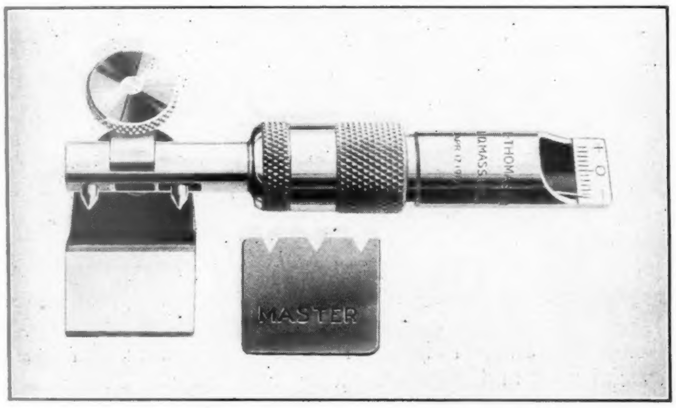


Simplex Gage Glass Guard

shield as shown in the illustration, which operates in circular tracks at the top and bottom. A cord attached to this shield and carried to some convenient part of the boiler room remote from the glass is used to operate the shield in the curved tracks. Whenever a glass becomes broken, the shield may be pulled around in front of the glass, thus deflecting the steam and water away from the handle of the valves, enabling them to be closed without danger to the workman. By pulling the shield still further around it will be removed from the tracks, thus giving an unrestricted opportunity for installing a new glass. Before the valves are again opened, the shield is put in its protecting position. This is done to prevent accident in case the new glass should break. When it has been determined that the glass has been properly applied, the shield is turned back to its original position. The interior of the shield is so finished that the water level may be easily read in the glass. The device is of simple construction and can be mounted on the gage rod brackets of any water gage.

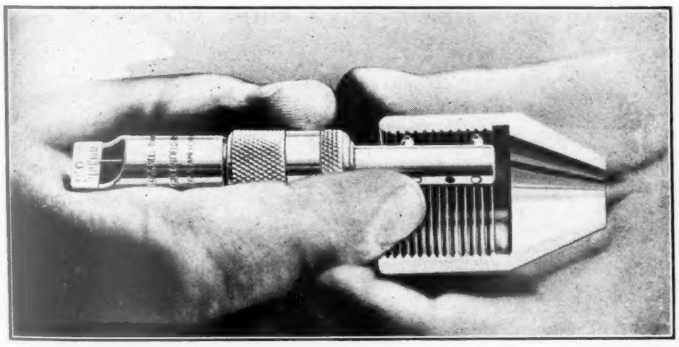
THREAD LEAD INDICATOR

The Bucknell-Thomas Company, Greenfield, Mass., has recently placed on the market a simple and inexpensive but accurate device for testing the lead on screw threads, both external and internal. The illustrations clearly show the construction and method of using the instrument for measur-



Bicknell-Thomas Thread Lead Indicator

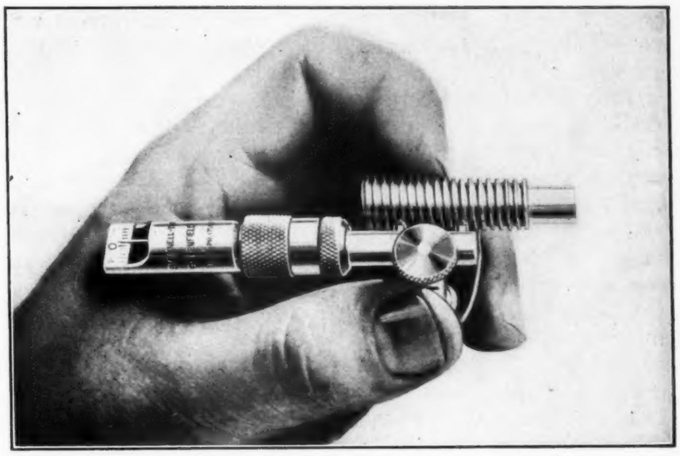
ing the lead on both the screw and inside the tapped hole. In use, the tool is held in one hand, preferably the left, and the screw is pressed against the two points which are spaced ¼ in., ½ in. or 1 in. apart, as desired. If the lead of the



Testing an Internal Thread for Lead

thread is normal the indicator needle will register at zero; if the lead is short the needle will show on the minus side; if long, on the plus side. Each line of the graduation represents .001 in.

The little table on which the screw rests in testing is easily adjusted to any height to accommodate screws of any diameter. For internal measuring the table is removed merely by loosening the thumb screw and drawing it off. The end of the instrument containing the point is small enough so that tapped holes, as small as ½ in. in diameter, can be tested and of course from that up to any size. This is a feature which is of the utmost importance in making sure that the



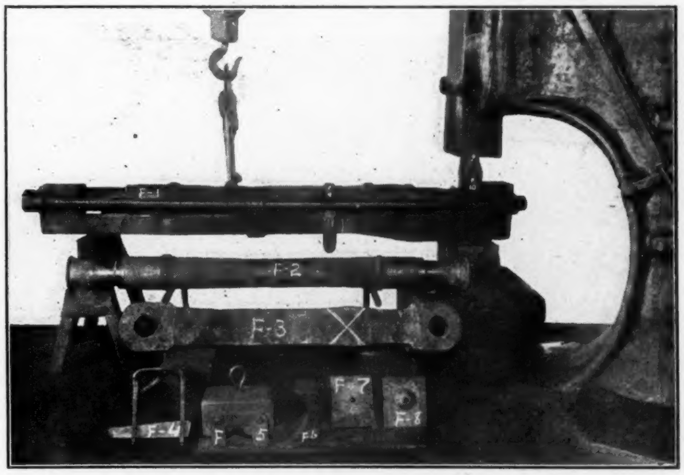
Application of the Thread Lead Indicator to Screws

lead of the thread on both the screw and in the tapped hole are the same.

A master is furnished with each gage so that the operator may be sure at all times that the needle point is on zero when the gaging points are spaced correctly. If it is necessary to test threads with odd pitches, such as 13 threads to the inch, a master gage can be furnished to which the indicating point can be adjusted.

JIG FOR USE IN UPSETTING AXLES AND DRAWBARS

A jig for use in reclaiming tender axles and engine and tender drawbars has been developed and patented by J. J. Lynch and H. Pfluger at the St. Paul shops of the Chicago, St. Paul, Minneapolis & Omaha, the use of which reduces the labor required to a minimum. But a few minutes are required for the performance of the work, aside from the time



Jig and Tools for Upsetting Drawbars and Axles Under the Steam Hammer

in the fire. The jig consists of a heavy bar with shoulders at either end, the face of one being vertical, and the other oblique. To increase the stiffness of the device, the shoulders are tied together with heavy rods.

As shown in the photograph, the jig is being used for the reclamation of a worn axle. After one end of the axle has

been heated, it is placed in the jig with the cold end against the vertical shoulder and a wedge is driven down between the heated end and the oblique shoulder under a steam hammer. This upsets the end of the journal, reducing it in length about one inch, the amount required at either end to reduce the length to that required for the next size smaller. The practice is to convert worn axles with 5½-in. by 10-in. journals to 5-in. by 9-in. journals, and the latter when worn to 4½-in. by 8-in. journals, two operations being required for each axle.

Engine and tender drawbars from large power come to the shop frequently to be shortened and to have worn holes rounded up. In doing this work, the end of the bar is heated, after which it is placed in the jig. The tool designated *F* 6 in the photograph is then placed against the hot end of the bar and the wedge shown at *F* 10 is driven down under the steam hammer. This closes the eye of the bar and the hole is then rounded up by driving through it a pin of the proper size. The entire operation requires about five minutes.

The holes in both ends of the bar shown in the photograph have been rounded up, and in addition the bar has been heated and shortened in the body, reducing it in length two inches.

In performing the operations, both on axles and drawbars, three men are required. Two helpers place the piece in the jig, the blacksmith holds the wedge in position and the steam hammer drives it home. The tools *F* 4, 5 and 6 are used in shortening and closing the holes in the ends of drawbars, *F* 5 being adjusted on the jig to suit the varying lengths of the bar. The tools shown at *F* 7 and 8 are used when upsetting the ends of axles; *F* 8 is used in the first operation on the axle, spreading the stock radially at the extreme end of the journal and centering the axle at the same time. Tool *F* 8 is then removed and replaced by *F* 7, which smoothes up the end of the axle and leaves ample stock for the collar of the returned journal. A clamp shown at *F* 9 is used to hold the work in position in the jig.

INSULATION FOR PASSENGER CAR FLOORS

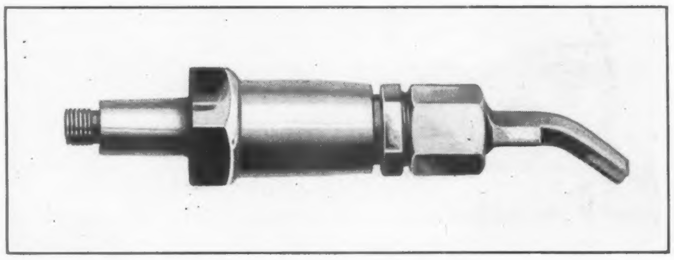
A mineral insulating material for use in passenger car floor construction, which somewhat resembles wool felt in appearance and texture, has recently been placed on the market by the Tuco Products Corporation, New York. This material, which is marketed under the trade name of Tucork, is manufactured from a material secured in rock form, which is melted and blown into a mineral wool. This in turn is mixed with a liquid binder, the mixture being poured into containers of proper depth, depending upon the thickness of insulation desired. These containers have a wire mesh bottom through which the liquid is permitted to drain off, the solid material settling on the screen in sheets, the thickness of which depends upon the depth of the liquid mixture in the tank. After draining, the material is placed in drying ovens where all the moisture is evaporated, the material in its final form being made up of 85 per cent to 90 per cent enclosed air cells.

Tucork Floor Insulation in Place

Being of mineral structure, the insulation is fireproof and tests have shown that it is practically waterproof. After being submerged in water for a period of one hour, the material shows a gain in weight of only one per cent. The material is light and is manufactured in the form of blocks or sheets which are quickly and easily applied. A cement is furnished with which the blocks are secured to the sheets on which they rest and with which all joints are sealed.

SPECIAL TIP FOR CUTTING RIVET HEADS BY THE OXY-ACETYLENE PROCESS

For cutting off rivet heads and stay-bolts flush with plates, by the oxy-acetylene process, it is desirable to have a cutting tip so designed as to permit the gas jet playing parallel with the plates. To meet this need the Prest-O-Lite Company, Inc., Indianapolis, Ind., is manufacturing a special rivet and stay-bolt cutting attachment. This attachment is used in connection with the Type *K* cutting blowpipe being screwed into the head in place of the regular cutting nozzles. The copper tip is bent at a convenient angle and is adjustable to any position, facilitating operation in close quarters.



Special Tip for Cutting Rivet Heads by Oxy-Acetylene Process

Much cleaner work in rivet and stay-bolt cutting is pos-

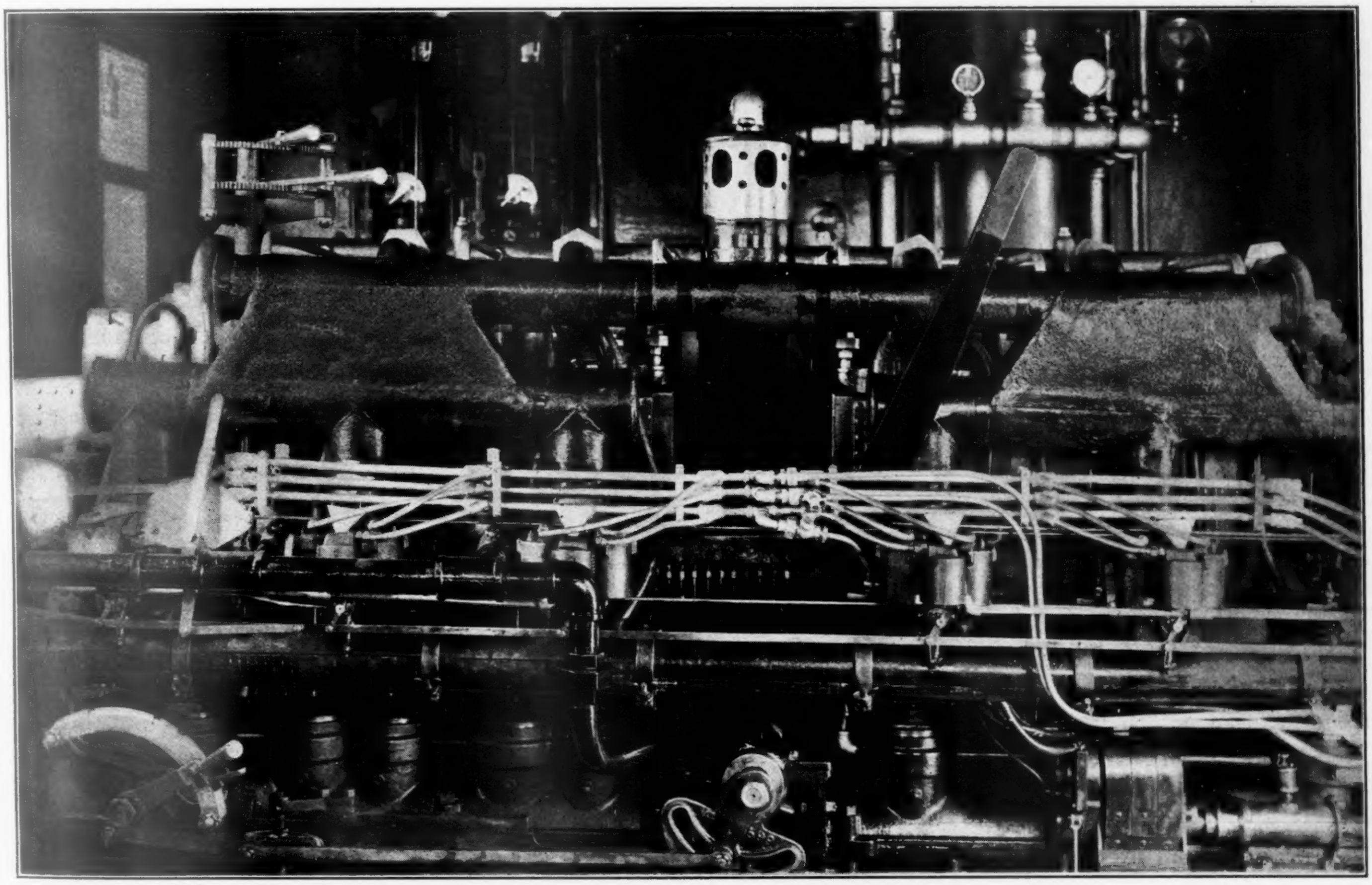
sible with this attachment than with standard cutting tips which do not permit making a cut truly parallel with the plates.

KEROSENE ENGINE FOR McKEEN MOTOR CARS

The McKeen Motor Car Company, Omaha, Neb., has developed a method for using kerosene instead of gasolene as fuel in its railway motor car engines. Cars operating with this fuel have been in use for about two months and the results are reported to be satisfactory in all respects. The use of kerosene effects a saving of 74 per cent of the cost of fuel as compared with gasolene and a reduction in the cost of operation per train-mile of 31 per cent. There is no appreciable increase in the cost of maintenance, a little more attention from the motorman being all that is required.

The successful use of kerosene is the result of a series of experiments carried on during the past five years by this company. Various grades of distillate have been used for about two years and the latest developments have made it possible to go a step farther and utilize kerosene. The operation of kerosene carburetors was found to be unsatisfactory. In the present design one carburetor of the multiple jet type is applied to each cylinder. The kerosene is atomized and delivered to the cylinder with a mixture of tempered air, there being eight nozzles for each cylinder. When running light only one nozzle per cylinder is used, the others coming into action when the throttle is opened. Through the use of one carburetor for each cylinder the manifold has been eliminated. The supply of hot and cold air can be regulated and for use on heavy grades water jets are provided. Kerosene does not mix with air as readily as distillates or gasolene, but the use of tempered air and mechanical means of regulating the quantity as well as atomizing the fuel make it possible to secure the proper explosive mixture under all conditions. To avoid undue complications in control the engine is started on gasolene and after it is in motion kerosene is substituted. The trouble which is sometimes encountered with the lubrication of internal combustion engines using kerosene has been satisfactorily overcome.

The first car equipped to use gasolene was a steel passenger car weighing 65,000 lb. It has a 200-horsepower, 6-cylinder engine, of the variable speed type. At the present time it is in branch line local passenger service, making an average of 210 miles a day. Since kerosene has been substituted for gasolene on this run there has been an increase of from 25 to 50 per cent in the mileage per gallon of fuel. The power developed on grades is materially increased and the motorman has expressed satisfaction on account of the greater ease in making the scheduled running time. It is felt that the slight additional complication of parts and the increase in the cost of the apparatus is insignificant as compared with the economy which has been obtained by the use of kerosene.



McKeen Motor Car Engine Which Uses Kerosene as Fuel

Lack of Lubricants in Germany.—Press despatches from London, reported under date of April 30, that when application was made in the prize court on that day for condemnation of several shiploads of lubricating oils and fats as enemy property, counsel read an affidavit from a member of the war trade intelligence department in which it was stated that latest reports in the hands of the government showed that 8,000 locomotives were laid up at Essen alone in March on account of wear and tear caused by the scarcity of lubricating oils in Germany or by the employment of bad lubricants. The lubrication of railway engines was said to be one of the pressing problems in Germany. (There were something over 30,000 locomotives in Germany before the war.)

Railway Mechanical Engineer

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WE GUARANTEE, that of this issue 9,000 copies were printed; that of these 9,000 copies 7,930 were mailed to regular paid subscribers, 112 were provided for counter and news companies' sales, 292 were mailed to advertisers, 190 were mailed to exchanges and correspondents, and 476 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 72,747, an average of 9,083 copies a month.

THE RAILWAY MECHANICAL ENGINEER is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.).

According to a recent announcement of the Chicago & North Western, 79 employees have entered army or navy service. There have been enlistments from practically all departments.

As the result of a movement instituted by employees of the Chicago Great Western, $1,640 was recently collected and sent to the Great Western company of the Thirteenth Engineers, then stationed in Chicago, to provide greater comforts for the men. R. B. Parrott, passenger conductor, was chairman of the employees' committee which handled the contributions, and George Bristow, assistant general passenger agent, Chicago, was secretary.

The Louisville & Nashville has made arrangements to buy a large quantity of goggles to supply every man in its shops in Kentucky. If the men do not wear the glasses, after the employer furnishes them, they must themselves bear the risk of injuries, which could have been prevented by wearing glasses. Under the Kentucky Workmen's Compensation law credits are given on the basic risk rates on liability insurance where employers adopt safety first measures. One of these credits is in connection with the furnishing of goggles.

The Pennsylvania Railroad has decided to suspend, temporarily, the regulation covering the age limit for employment. The rule heretofore in force prohibited the hiring of new employees in any branch of the service, above the age of 45 years. Under the new rule, which has been adopted to meet war conditions, persons between the ages of 45 and 70 years may be employed during the war and for a period of six months thereafter. Such employment is not to be considered permanent, and it will not carry with it the privileges of the pension department. Numbers of former employees have already been taken into the service.

Samuel M. Felton, president of the Chicago Great Western and heretofore adviser to General Black, chief of engineers of the United States army, has been appointed by the Secretary of War director general of railways, with office at Washington, D. C. According to the order announcing his appointment, Mr. Felton is charged under the chief of engineers with the organization and despatch abroad of all railway forces and the purchase of all railway material, both for initial action and for continuous supplies for operation. Mr. Felton has been in charge of the organization of the railway engineer regiments for service abroad.

The Thirteenth Engineers (Railways), United States Army, has moved to the Atlantic seaboard on its way to France. Two companies started on July 18, and the remainder of the contingent on July 21. All of the nine railway regiments organized under the direction of S. M. Felton, president of the Chicago Great Western, were recently renamed and renumbered, ten having been added to each of the former numbers. For example, the regiment until recently stationed at Chicago and formerly known as the Third Reserve Engineers, is now the Thirteenth Engineers (Railways), United States Army. Before leaving their quarters on the Municipal pier at Chicago, the Thirteenth Engineers (Railways), United States Army, were presented with regimental colors by S. M. Felton, president of the Chicago Great Western, and C. H. Markham, president of the Illinois Central.

A controversy between the railroads and the shopmen employed on the southeastern railroads, involving about 25,000 men, who demanded an increase of 10 cents an hour and an eight-hour day, has been referred to the United States Department of Labor for mediation, with an agreement on the part of both the employers and the men to abide by the decision of the Secretary of Labor in case the conciliators of the department are not able to effect a settlement. The railroads offered increases amounting to six cents an hour, with an eight-hour day, for about 90 per cent of the men involved, but this was not accepted by the men and a strike had been called, to become effective July 12, when the mediation agreement was reached. The wage increase will amount to about $1,000,000 a year, for the roads involved, for each cent per hour.

J. A. F. Aspinall, general manager of the Lancashire & Yorkshire, is now a knight, that honor having been conferred on him by King George on his last birthday. Mr. Aspinall is a member of the Railway Executive Committee now managing the railways under the war regime. He was born in 1851. He was educated at Beaumont college, Berkshire, and his first railway service was in the shops of the London & North Western at Crewe. From 1875 to 1886 he was a shop superintendent on the Great Southern & Western of Ireland. In the last named year he went to the Lancashire & Yorkshire as chief mechanical engineer and he has been with that company ever since. The extensive shops of that company, at Horwich, were laid out under his supervision. He was appointed general manager in 1899. In 1907 he was chairman of the general manager's confer-

ence at the Railway Clearing House, and in 1909-1910 he was president of the Institution of Mechanical Engineers.

A. J. Earling, president of the Chicago, Milwaukee & St. Paul, has presented a copy of Elbert Hubbard's "Message to Garcia" to each of the members of the St. Paul company of the Thirteenth Engineers (Railways), who will leave for France this summer to operate railroads at the front. On the cover of the booklet is a print of the American flag in colors, under which is the following quotation from President Wilson's war message: "The world must be made safe for democracy. Its peace must be planted upon the tested foundations of political liberty." The text is prefaced by Mr. Earling's own message to the men: "In wishing the officers and employees of the Chicago, Milwaukee & St. Paul God-speed as they depart for the front, it is my sincere wish that each and every one may have the opportunity of delivering that message to Garcia and safely return to the happiness of his home with the consciousness of having been ready and a realization that the hero of the war was the man who delivered the message when called upon."

Car and Locomotive Orders in July

Of the 518 locomotives reported in July, 400 were on government orders, 300 for the United States Government and 100 for the British Government. During July also, the order was signed for the 500 Russian Government Decapod locomotives, but these are not included in the July totals because they were included in June. The 300 locomotives for the United States Government are 80-ton Consolidation locomotives for service with our own forces in France. The order was divided evenly between the American Locomotive Company and the Baldwin Locomotive Works. Those to be built by the former are duplicates of the locomotives now on order for the French State Railways. Those to be built by the Baldwin Locomotive Works are to be similar to the British Government locomotives some of which were recently delivered.

The orders were as follows:

	Locomotives.	Freight Cars.	Passenger Cars.
Domestic	415	5,570	....
Foreign	103	1,200	....
Total	518	6,770	....

The important locomotive orders included the following:

Atchison, Topeka & Santa Fe	100		Baldwin
United States Government	150	Consolidation	American
	150	Consolidation	Baldwin
British Government	100	Consolidation	Baldwin

Among the important freight car orders were the following:

Canadian Government Railways	1,000	Box	National
Grand Trunk	1,000	Box	Am. C. & F.
Pennsylvania R. R.	2,000	Box	Altoona
	100	Flat	Altoona
	100	Cabin	Altoona
	25	Well	Altoona
Union Railroad	1,500	Coke	Ralston

Pennsylvania Electric Locomotive

In the article describing the Pennsylvania's new electric locomotive which was published in the *Railway Mechanical Engineer* of July, on page 379, the fact that the electrical equipment was supplied by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., was omitted through oversight. This company provided the motors and all electrical apparatus used on this locomotive.

How Long Is a Long Time?

The following statement, given out by one of the eastern roads, calls attention to the far-reaching effects of its heavy curtailment of passenger service:

"The New York, New Haven & Hartford, which has taken off 199 passenger trains, is thereby saving, each week, 2,054 tons of coal, equal to an annual saving of 106,828 tons. As two tons of coal will warm a family of five persons a long time, it is estimated that by reason of this economy of train service nearly 270,000 persons could be kept comfortable during the coming winter."

Women on the New York Central

Women have made "a splendid start" on the New York Central, according to a statement made by an officer of the road. A gang of thirty women, under direction of a woman bookkeeper, is employed at Collinwood, Ohio, in sorting 3,000 tons of scrap metal. They do the work as well as men, and appear to like it. The woman who does the same work as a man will get the same pay. Those women who are sorting scrap get an average of $2.50 a day.

The number of women employed in the auditing department has been increased; and there are many in the car record office. Some are being trained in the purchasing department, to sell tickets, and to act as watchmen at railroad crossings. In the shops women are learning to run lathes, drills and other small tools, and women will be employed as assistants in stations. One woman has been in the service as watcher at a railroad crossing for the last ten years.

Vice-President A. T. Hardin says: "Our present work is centered largely in organization and training. The women we are training are in many instances relatives of our employees. Many women have extraordinary energy and power for constructive work, which has never been put to practical use. The war gives them an opportunity to serve their country and themselves."

MEETINGS AND CONVENTIONS

Railway Equipment Manufacturers' Association.—At a meeting of the executive committee of the Railway Equipment Manufacturers' Association at Chicago, June 11, the convention of the association for this year was canceled.

Master Car and Locomotive Painters' Association.—Owing to the state of war declared and now existing between the United States and Germany, it has been decided by the president and executive board that the forty-eighth annual convention of the Master Car and Locomotive Painters' Association of the United States and Canada will be postponed until further notice.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations:

Air Brake Association.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

American Railroad Master Tinners', Coppersmiths' and Pipefitters' Association.—O. E. Schlink, 485 W. Fifth St., Peru, Ind. Convention postponed.

American Railway Master Mechanics' Association.—J. W. Taylor, Karpen Bldg., Chicago. Convention postponed.

American Railway Tool Foremen's Association.—R. D. Fletcher, Belt Railway, Chicago. Convention postponed.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth St., New York.

Association of Railway Electrical Engineers.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago.

Car Foremen's Association of Chicago.—Aaron Kline, 841 Lawlor Ave., Chicago. Second Monday in month, except June, July and August, Hotel La Salle, Chicago.

Chief Interchange Car Inspectors' and Car Foremen's Association.—W. R. McMunn, New York Central, Albany, N. Y. Convention postponed.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, C. H. & D., Lima, Ohio. Convention postponed.

International Railway Fuel Association.—J. G. Crawford, 547 W. Jackson Blvd., Chicago.

International Railway General Foremen's Association.—William Hall, 1126 W. Broadway, Winona, Minn. Convention postoned.

Master Boilermakers' Association.—Harry D. Vought, 95 Liberty St., New York. Convention postponed.

Master Car Builders' Association.—J. W. Taylor, Karpen Bldg., Chicago. Convention postponed.

Master Car and Locomotive Painters' Association of U. S. and Canada.—A. P. Dane, B. & M., Reading, Mass. Convention postponed.

Niagara Frontier Car Men's Association.—E. N. Frankenberger, 623 Brisbane Bldg., Buffalo, N. Y. Meetings, third Wednesday in month, New York Telephone Bldg., Buffalo, N. Y.

Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio. Convention postponed.

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. R. R., Cleveland, Ohio.

PERSONAL MENTION

GENERAL

J. R. Dwyer has been appointed fuel supervisor on the Louisiana division of the Texas & Pacific, with headquarters at Alexandria, La., succeeding D. H. Varnell, assigned other duties.

J. J. Hanlin, master mechanic of the Seaboard Air Line at Howells, Ga., has been appointed assistant superintendent of motive power, with headquarters at Portsmouth, Va.

H. H. Maxfield, superintendent of motive power of the New Jersey division of the Pennsylvania Railroad, has been granted a furlough to enter military service as an officer of the Ninth Engineers of the National Army, the Railway Shop regiment.

B. B. Milner, engineer of motive power of the New York Central, at New York, has also been assigned the duties heretofore performed by the chief mechanical engineer, R. B. Kendig, deceased. The office of chief mechanical engineer has been abolished.

Joseph Slutzker, assistant master mechanic of the Altoona machine shops of the Pennsylvania Railroad, has been promoted to assistant engineer of motive power of the Western Pennsylvania division.

A. E. Voight, assistant electrical engineer of the Atchison, Topeka & Santa Fe, has been appointed electrical engineer, with headquarters at Topeka, Kan.

F. G. Grimshaw, assistant engineer electrical equipment of the Philadelphia Terminal division of the Pennsylvania Railroad, has been promoted to superintendent of motive power of the New Jersey division, with headquarters at New York, succeeding H. H. Maxfield. Mr. Grimshaw was born on November 26, 1878, at Paterson, N. J., and was educated at Cornell University. After serving for one year in the Cooke Locomotive Works, he entered the service of the Pennsylvania Railroad in 1902 as special apprentice in the Altoona machine shops. From 1905 to August, 1906, he served successively as yard clerk and assistant yardmaster on the Pittsburgh division, and then was appointed assistant master mechanic of the Monongahela division. In June, 1907, he was appointed master mechanic on the West Jersey & Seashore, serving in that capacity until September, 1912, when he was appointed assistant engineer of motive power on the Western Pennsylvania division of the Pennsylvania Railroad at Pittsburgh, Pa. In November, 1914, he was transferred to Philadelphia as assistant engineer of electric equipment.

F. G. Grimshaw

T. J. Hamilton, district master mechanic of the Chicago, Milwaukee & St. Paul, at Tacoma, Wash., has been appointed assistant superintendent of the Missoula division, with headquarters at Avery, Idaho.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

C. D. Barrett, master mechanic of the Pennsylvania Railroad, at Sunbury, Pa., has been granted a furlough to enter military service as an officer of the Ninth Engineers of the National Army, the Railway Shop regiment.

A. H. Beirne, general roundhouse foreman of the Atchison, Topeka & Santa Fe at Albuquerque, N. M., has been appointed master mechanic of the Western division, with headquarters at Dodge City, Kan., succeeding Edward Norton.

Robert G. Bennett, assistant engineer of motive power of the Central division of the Pennsylvania Railroad, has succeeded C. D. Barrett as master mechanic at Sunbury, Pa. Mr. Bennett was born at Brighton, England, on March 31, 1882. He entered the service of the Pennslyvania Railroad in 1900 as a machinist apprentice in the Erie, Pa., shops, completing his apprenticeship at the Renovo, Pa., shops four years later. He graduated from Purdue University in 1908 as a bachelor of science in mechanical engineering and in 1915 he was given the degree of mechanical engineer. While attending college, he worked during the summer months as a machinist, draftsman and inspector and in November, 1908, was appointed motive power inspector of the Monongahela division. In March, 1912, he was transferred to the Pittsburgh division as rodman in the maintenance of way department, and a year later he became inspector in the test department at Altoona, Pa., being assigned to the locomotive test plant on bulletin work. In May, 1916, Mr. Bennett went to Chambersburg, Pa., as assistant master mechanic of the Cumberland Valley Railroad and returned to the Pennsylvania Railroad in February, 1917, as assistant engineer of motive power of the Central division at Williamsport, Pa.

R. G. Bennett

G. E. Cessford, district master mechanic of the Chicago, Milwaukee & St. Paul, at Deer Lodge, Mont., has been transferred to Tacoma, Wash., succeeding T. J. Hamilton, promoted.

George C. Christy, general foreman of the McComb shops of the Illinois Central, has been appointed master mechanic at Vicksburg, Miss., succeeding C. Linstrom, deceased. Mr. Christy was born at Water Valley, Miss., on December 7, 1882. He entered the service of the Illinois Central at that point on June 1, 1898, and worked consecutively as painter, machinist apprentice, machinist, roundhouse foreman, and erecting shop foreman, being appointed general foreman of the Water Valley shops in October, 1911. He was transferred to the McComb shops in December, 1914, as general foreman, in which capacity he served until his recent promotion.

F. P. McDonald has been appointed master mechanic of the Stockton division of the Southern Pacific at Stockton, Cal., succeeding A. D. Williams, promoted.

W. R. Meeder has been appointed master mechanic of the Illinois Southern, with office at Sparta, Ill., succeeding W. F. McCarra resigned.

C. S. Gaskill, master mechanic of the Pennsylvania Railroad at Orangeville, Md., has received a furlough to enter military service as an officer of the Railway Shop regiment, the Ninth Engineers.

D. J. McCuaig, acting master mechanic of the Grand Trunk at Toronto, Ont., has been appointed master mechanic of the Ontario lines, with headquarters at Toronto.

H. L. Needham, general foreman of the locomotive department of the Illinois Central at Twenty-seventh street, Chicago, has been appointed master mechanic of the Springfield division, with headquarters at Clinton, Ill., succeeding William O'Brien, assigned to other duties.

C. D. Rafferty has been appointed master mechanic of the Algoma Central & Hudson Bay, with office at Sault Ste. Marie, Ont., succeeding Thomas Fraser, resigned.

F. S. Robbins, assistant master mechanic of the Pennsylvania Railroad, at Pittsburgh, Pa., has been granted a furlough to enter military service as an officer of the Railway Shop regiment, the Ninth Engineers.

Edward Schultz, master mechanic of the Chicago & North Western at Chicago, has been recommended for first lieutenant in the Third Reserve Engineers.

Harry S. Schum, general foreman of the East Altoona enginehouse of the Pennsylvania Railroad, has been appointed assistant master mechanic of the Altoona machine shops.

M. F. Smith, district master mechanic of the Chicago, Milwaukee & St. Paul at Dubuque, Iowa, has been transferred to Milwaukee, Wis., succeeding A. Young, resigned to enter military service.

Leon A. Starkweather, motive power inspector of the Pennsylvania Railroad, has been appointed assistant master mechanic of the New York division.

J. H. Thomas, assistant general foreman of the Pennsylvania Railroad, at Pitcairn, Pa., has been appointed assistant master mechanic at Pittsburgh, succeeding F. S. Robbins.

G. H. Watkins, assistant engineer of motive power of the Western Pennsylvania division of the Pennsylvania Railroad, has been appointed master mechanic of the Baltimore division at Orangeville, Md., succeeding C. S. Gaskill. Mr. Watkins was born on April 17, 1881, at Charlotte Court House, Va. He entered the Altoona shops of the Pennsylvania Railroad as a special apprentice on June 24, 1903, and was made an inspector on June 1, 1907. He was transferred to the Delaware division as enginehouse foreman on September 1, 1910, serving in that capacity until November of the same year when he was promoted to assistant master mechanic at the Meadows shops. Three years later Mr. Watkins was assigned to the Pittsburgh division and on November 1, 1914, he became assistant engineer of motive power of the Western Pennsylvania division.

Alexander Young, district master mechanic of the Chicago, Milwaukee & St. Paul at Milwaukee, Wis., has been recommended for a commission of captain in the Third Reserve Engineers.

SHOP AND ENGINEHOUSE

Amos C. Davis, general foreman of the Altoona erecting shops of the Pennsylvania Railroad, has been appointed general foreman of the East Altoona enginehouse.

Charles W. Davis, assistant roundhouse foreman of the Atchison, Topeka & Santa Fe at Dodge City, Kan., has been appointed division foreman at Deming, N. M.

H. G. Flanders, roundhouse foreman of the Atchison, Topeka & Santa Fe, at Clovis, N. M., has been promoted to general foreman at that point.

Lyle H. Gibbs has been appointed general foreman of the Atchison, Topeka & Santa Fe at Shawnee, Okla.

William Gruys, general foreman of the Atchison, Topeka & Santa Fe at Waynoka, Okla., has been appointed general foreman at Wellington, Kan.

F. P. Howell, erecting shop foreman of the Atlantic Coast Line at Waycross, Ga., has been appointed general foreman at that point.

E. S. Meyer has been appointed gang foreman of the Waycross shop of the Atlantic Coast Line, succeeding H. C. Spicer, promoted.

Frank E. Myers, roundhouse foreman of the Atchison, Topeka & Santa Fe, at Waynoka, Okla., has been appointed general foreman at that point.

J. Ormsby has been appointed general foreman of the locomotive department of the Illinois Central at Twenty-seventh street, Chicago, succeeding H. L. Needham.

Samuel R. Parslow, formerly general machine foreman of the Great Northern at the Dale street shops, St. Paul, Minn., and for the past two years engaged in mechanical valuation work for that company, has been appointed shop superintendent of the new shops at Great Falls, Mont.

H. C. Spicer, formerly gang foreman of the Atlantic Coast Line at Waycross, Ga., has succeeded F. P. Howell as erecting shop foreman of the Waycross shop.

PURCHASING AND STOREKEEPING

J. L. Feemster, storekeeper of the Kansas City Terminal Railway at Kansas City, Mo., has been appointed general storekeeper of the Chicago Great Western, with headquarters at Oelwein, Iowa.

Leonard L. King has been appointed division storekeeper of the Illinois Central, at McComb, Miss., succeeding W. S. Morehead.

S. F. Langton has been appointed division storekeeper of the Atchison, Topeka & Santa Fe, at Seligman, Ariz., succeeding S. C. Fogarty.

August W. Munster, whose appointment as purchasing agent of the Boston & Maine, with headquarters at North Station, Boston, Mass., was announced in these columns last month, was born on July 24, 1882, at Waltham, Mass. He was educated in the Massachusetts Institute of Technology, and in 1904 began railway work with the Northern Pacific, where he served as a machinist and material inspector. In 1909, he went to the New York, New Haven & Hartford as material inspector, and subsequently served as chief inspector and engineer of tests. In 1911 he went to the Boston & Maine as general storekeeper, which position he held at the time of his recent appointment as purchasing agent.

George W. Rice has been appointed division storekeeper of the Illinois Central, at Memphis, Tenn., succeeding L. L. King.

NEW SHOPS

Union Pacific.—This road will carry out improvements during 1917 to include the construction of new shops, roundhouse facilities, coaling stations, etc., at Omaha, Neb., at a cost of $3,000,000. Plans for this work have not yet been completed except for a new power house and extensions to shops at Omaha, to cost $656,000.

New York Central.—A contract has been given to John W. Cooper & Co., Buffalo, N. Y., for building an enginehouse with turntable and annex buildings, in the freight yards at Gardenville, N. Y. The work calls for putting up a structure 35 ft. high, 100 ft. wide and 500 ft. long, with concrete foundations, and brick and timber super-structure. The approximate cost of the work will be $150,000.

SUPPLY TRADE NOTES

Charles B. Yardley has been elected president of Steel & Iron Mongers, Inc., with offices at 796 Broad street, Newark, N. J.

At a meeting of the board of directors of the American Locomotive Company, held June 21, L. A. Larsen was appointed assistant comptroller.

A. D. Bruce, in charge of purchases and supplies for the Vapor Car Heating Company, Inc., Chicago, has been elected secretary and controller, succeeding Arthur P. Harper, resigned.

G. A. Cooper, representative in the railroad department of the United States Graphite Company, at Chicago, has been appointed advertising manager of the company, with headquarters at Saginaw, Mich.

H. G. Doran & Co., Peoples Gas building, Chicago, have been appointed selling agents for the Schaefer Equipment Company, Pittsburgh, Pa., manufacturers of the Schaefer truck lever connections.

The American Steel Foundries, Chicago, has purchased the Eclipse cast steel coupler yoke from the National Car Equipment Company. The Eclipse yoke requires neither keys nor rivets, and is now in use on a large number of railroads.

D. B. Mugan, who was formerly in charge of the electrical department of the Illinois Central at New Orleans, La., has been appointed resident manager of the Edison Storage Battery Supply Company, with headquarters at 201 Baronne street, New Orleans, La.

Willard Doud, consulting engineer, Old Colony building, Chicago, Ill., has closed his office temporarily, to accept a commission as lieutenant, junior grade, in the United States Naval Reserve. He has been assigned to active service at the Naval Training Station, Great Lakes, Ill.

At a meeting of the executive committee of the board of directors of the American Locomotive Company, held July 18, David Van Alstyne was appointed an assistant vice-president, in charge of manufacture. Mr. Van Alstyne has hitherto held the title of assistant to vice-president.

Charles S. Clark, formerly sales agent of the Pennsylvania Steel Company at Boston, Mass., has been elected first vice-president and general manager of the Laconia Car Company, and will make his headquarters at Laconia, N. H., where the business of the company will be transacted hereafter.

L. O. Cameron, formerly manager of sales in the southern district for the Pressed Steel Car Company, has opened an office in the Munsey building, Washington, D. C., and will hereafter represent the Pressed Steel Car Company, and the Oxweld Railroad Service Company. He will also handle government accounts.

The Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, has elected the following new officers: M. G. Lodge, president; J. W. Carrell, vice-president and general manager, and L. A. Hall, secretary and treasurer. Murray Shipley has sold his entire interest in the company and has severed his connection with it.

Among those in the service of the American Steel Export Company, New York, who have been called to the colors, is K. G. Martin, manager of the service and publicity departments. Mr. Martin was granted an honorable discharge from the 22nd Regiment, Corps of Engineers, N. G., N. Y., in order to be able to accept a commission as captain, Officers' Reserve Corps, Motor Transport Service.

The Mark Manufacturing Company, Chicago, will spend approximately $14,500,000 in the construction of a steel plant at South Chicago. This is $9,500,000 in excess of the cost as estimated a year ago. The new plans provide for the construction of a 600-ton blast furnace, with docks, ore and coke handling machinery, which was not in the original plans. The new plans also provide for an open hearth steel department with a capacity of 250 gross tons of ingots per year.

Daniel A. Wightman, formerly general manager of the Pittsburgh Locomotive Works, died at Warren, R. I., on July 6. Mr. Wightman was born at East Greenwich, R. I., in 1846. He was educated in the public schools of that town, and after a course in an evening school in Providence, entered the employ of the Rhode Island Locomotive Works as a draftsman. In 1876 he went to the Pittsburgh Locomotive Works as superintendent. He later became general manager and held that position when he retired in 1902.

The Walter A. Zelnicker Supply Company, St. Louis, Mo., and affiliated companies are now represented in the Birmingham district by Thomas A. Hamilton, who for the past 14 years has been connected with the Crane Company, prior to which he was superintendent of the East St. Louis plant of the Zelnicker Car Works. Mr. Hamilton will have charge of both buying and selling in the southeastern district. His office will be at 1018 Woodward building, Birmingham, Ala.

The Walter A. Zelnicker Supply Company, St. Louis, Mo., announces the appointment of W. H. Dayton as city salesman. Mr. Dayton was formerly with the Railroad Supply Company, Chicago, as secretary and purchasing agent, and also eastern representative for five years. He went to St. Louis seven years ago, representing the same firm, the Chicago Signal & Supply Company, and the Elyria Iron & Steel Company, manufacturers of signal and track maintenance materials.

Roland C. Fraser, vice-president of the Buffalo Brake Beam Company at New York, died on July 17 at his home at Suffern, N. Y. He was born at Boston, Mass., on April 11, 1865. Mr. Fraser was widely known in the supply trade. He began his business career in the railway supply field by joining the business staff of the Railroad Gazette in 1890. After several years' service in that position he was employed, successively, by the Monarch Brake Beam Company, of Detroit; the U. S. Metal & Manufacturing Company, of New York, and the Buffalo Brake Beam Company, of New York. At the time of his death he was vice-president of the last named company and had been in its service for 14 years.

R. C. Fraser

A gift of $385 was recently made to the Thirteenth Engineers, United States army, by seven Chicago railway supply companies. Of this amount, $85 was used to cover the expenses of a band, which furnished music during a review of the regiment on July 12, and the remaining $300 will

be used to provide greater comforts for the men. The companies which contributed to the fund were the P. & M. Company, Robert W. Hunt & Co., the Railroad Supply Company; Fairbanks, Morse & Co.; the Rail Joint Company; the Galena-Signal Oil Company, and Pratt & Lambert.

Frank B. Bradley, vice-president of the Ajax Forge Company, Chicago, died at his home in Chicago, on July 14. Mr. Bradley was born at Lake Forest, Ill., on May 6, 1866, and entered the service of the Ajax Forge Company in 1884 as an office boy. With the exception of a few years' service with the Morden Frog & Crossing Works, the Buda Foundry Company and Clement Curtis & Co., he has been continuously with the Ajax Forge Company since that time, having special charge of the sales department in recent years. In addition to his sales duties he has invented and perfected several railroad track specialties.

The L. B. Stillwell Engineering Corporation has been organized to act as constructing engineer in the design and construction of steam and hydro-electric lighting, railway and power plants; electric transmission, electrification of railroads, the design and construction of steel rolling stock, railroad terminals, steam heating plants and general engineering construction work. The officers are: Lewis B. Stillwell, president; H. St. Clair Putnam, vice-president and general manager; Hugh Hazelton, vice-president, and W. Everitt Rundle, secretary and treasurer. The principal office of the corporation will be located at 100 Broadway, New York City.

Samuel Lindsay Nicholson, who has been sales manager of the Westinghouse Electric & Manufacturing Company since 1909, has been promoted to the position of assistant to vice-president, with headquarters at East Pittsburgh, Pa. Mr. Nicholson was born in Philadelphia, received his education in the William Penn Charter School of that city and began his business career as an apprentice with the Belmont Iron Works in 1887. He entered the electrical business the following year and served with various electrical companies until 1898, when he became sales representative of the Westinghouse Electric & Manufacturing Company, in New York. He subsequently had charge of the city and industrial division of the New York office. On the reorganization of the sales department in 1904, he was made manager of the industrial department, which position he filled until his selection as sales manager of the company in 1909.

S. L. Nicholson

David A. Munro, formerly manager of the J. N. Johns Manufacturing Company, has accepted a position with the Railway Specialties Corporation, New York, and will take active charge of that company's railroad department. Mr. Munro was born in Scotland. He came to this country in February, 1907, and in October of the same year entered the auditor's office of the Metropolitan Street Railway in New York. He was later assistant to the auditor of the Second Avenue Railroad of New York, and was shortly afterwards appointed purchasing agent to the receiver in addition to his other duties. On December 1, 1916, he resigned to enter the supply field as manager of the J. N. Johns Manufacturing Company.

W. G. Bee, vice-president and general sales manager of the Edison Storage Battery Company, Orange, N. J., died at his home in that city July 11, aged 48 years. Mr. Bee was born in Hartford, Conn., on December 14, 1868. He left school at the age of 15 and enlisted in the United States Navy as seaman's apprentice. After four years' service he received an honorable discharge and returned to Hartford and became associated with the Pope-Hartford Bicycle Company, which later became the Electric Vehicle Company of Hartford. In this way Mr. Bee became one of the pioneers of the electric vehicle industry. In the Spanish-American War, Mr. Bee was a chief gunner's mate on the U. S. S. "Gloucester," J. P. Morgan's yacht "Corsair." After the war Mr. Bee returned to the Electric Vehicle Company and spent some time in Mexico in its interests and was in charge of its exhibit at the Pan-American Exposition. In 1903, Mr. Bee became associated with Thomas A. Edison, then at Glen Ridge. When the Edison Storage Battery Company was organized in Orange, Mr. Bee became general sales manager, and in 1903 was elected vice-president.

W. G. Bee

Herbert Deeming, who has been appointed sales manager of Mudge & Co., with headquarters in the Railway Exchange, Chicago, was born in England on April 16, 1880. He began his business career as a stenographer and clerk in the general passenger department of the Fremont, Elkhorn & Missouri Valley at Omaha, Neb., in October, 1897. From July, 1899, to September he was with the American Express Company at Omaha, and from the latter month until January, 1900, he was employed in the general superintendent's office of the Fremont, Elkhorn & Missouri Valley. He was then promoted to secretary to the general freight agent of the same road, and in July, 1902, went to Chicago, where he was employed in the auditor's office of the Chicago & Western Indiana. In January, 1903, he was promoted to a position in the president and general manager's office. From July, 1903, to February, 1916, he was secretary of the General Managers' Association, at Chicago, and from November, 1907, to February, 1916, was also secretary of the Association of Western Railways. In March, 1916, he became assistant director of the Railway Educational Bureau at Omaha, Neb., and seven months later he became associated with the H. E. Reisman Advertising Company, which position he held until his recent appointment.

H. Deeming

W. F. Walsh, of the railway export department of the Galena-Signal Oil Company, has received a commission as

captain in the Engineer Reserves, United States Army. Mr. Walsh was formerly with the Chesapeake & Ohio, and while with that company held a commission as first lieutenant of the Roanoke Blues of the Virginia National Guard.

L. C. Sprague, formerly general motive power inspector of the Baltimore & Ohio, with headquarters at Baltimore, has been appointed special representative on air brake specialties for the general railroad department of the H. W. Johns-Manville Company, with headquarters in New York. Mr. Sprague has been in railway service since 1899, serving on the Chicago, Burlington & Quincy from that time to 1910 as fireman, engineman and then fuel inspector. In 1912 he became a locomotive and air brake instructor for the International Correspondence Schools, following which he was assistant general air brake instructor on the Great Northern at St. Paul. He became general motive power inspector of the Baltimore & Ohio in 1915.

Oden H. Wharton, formerly assistant to the president of the Crucible Steel Company, has been elected president of the company. Mr. Wharton was born at Easton, Pa., and received his schooling at that place. His first business association was with Park Brothers & Co., Ltd., at that time operating the Black Diamond Steel Works in Pittsburgh. He started as office boy, then became billing clerk and finally a salesman. Later he was connected with the sales department of the Park Steel Company in Cleveland and other cities. He went to Boston for some years as representative of the Park Steel Company, and later of the Crucible Steel Company of America, and was finally appointed general manager of sales of the latter company, with headquarters at Pittsburgh. After holding this position for several years his health failed, and he was succeeded by Reuben Michener, the present general manager of sales. Mr. Wharton traveled in Europe for a year or more, and, regaining his health, was appointed assistant to President Charles C. Ramsey, of the Crucible Steel Company, who died recently.

The Automatic Straight Air Brake Company

The Automatic Straight Air Brake Company of New York during the next few weeks will send out invitations to many of the leading railroad officers of the country to witness the operation of the automatic straight air brake, on a 100-car test rack at New York, and shortly thereafter to attend the road service trials, which will be conducted by the Division of Safety of the Interstate Commerce Commission.

The company has leased a building in which it has installed a 100-car test rack, which includes the complete car equipment arranged with full length train line and all other piping, just as it would be applied on a 100-car train. The apparatus for each car includes a trainagraph with three recording pens indicating respectively the pressure of the brake cylinder, the auxiliary reservoir and the train line. An observer can thus see at a glance just what takes place on each car in the train.

During the fall of 1915 this brake was tested in road service on the Atchison, Topeka & Santa Fe, under the supervision of the Division of Safety of the Interstate Commerce Commission, and since that time the improvements suggested by the commission in its report to Congress in June, 1916, have been made in the equipment. The principal features of the brake, an early form of which was described in the February, 1915, issue of the *Railway Age Gazette, Mechanical Edition,* page 92, are the use of wing valves, the movement of which is controlled by diaphragms under the action of differential pressures and the use of train pipe air for the service application of the brake, making possible the maintenance of a predetermined brake cylinder pressure indefinitely without the necessity of the release and reapplication of the brakes, and without the aid of retaining valves.

CATALOGUES

AIR COMPRESSORS.—Bulletin 34-Y, issued by the Chicago Pneumatic Tool Company, is a catalogue of that company's gas and gasolene driven air compressors.

BOILER KOTE.—The Boiler-Kote Company, Chicago, in a 16-page booklet, details the advantage of using Boiler-Kote in boilers, and shows how it is used to secure the desired results.

WRENCHES AND OTHER TOOLS.—One of the latest catalogues issued by the Mechanical Specialties Company, Chicago, is a 16-page booklet illustrating and giving list prices on the company's line of wrenches, chisels, punches and similar tools.

EXPORT ENGINEERING AND CONTRACTING.—This is the title of a booklet issued by the American Steel Export Company, New York. The book explains about the export organization of the company itself, and gives a detailed list of the many kinds of equipment it is in a position to design and supply.

CAR HEATING.—The Gold Car Heating & Lighting Company, New York, has recently issued a catalogue descriptive of the Gold electric thermostatic control of steam heating for passenger train cars. The booklet explains the advantages of this system from the standpoint of uniform heating and economies in the use of steam, and explains how the system secures the desired results.

ELECTRIC HOISTS.—The Sprague Electric Works of the General Electric Company, 527-531 West Thirty-fourth street, New York, has issued bulletin No. 48,923, describing Type W electric hoists, one to six tons capacity. The various sizes and types of these hoists are clearly shown by photographs, detailed drawings and dimension tables. General specifications for the hoists are also given.

THE STROH PROCESS.—The Stroh Steel-Hardening Process Company, Pittsburgh, Pa., has recently issued a 24-page catalogue descriptive of the Stroh process. This is a method for casting fine alloy steel together with soft steel in one solid piece, this giving a casting with a wear-proof alloy steel stratum upon the wearing surfaces, while the body is composed of any desired steel, and is in no way affected. The catalogue contains a number of illustrations showing gears, wheels, frogs, crossings, etc., of Stroh steel.

TURRET LATHE.—The International Machine Tool Company, Indianapolis, Ind., has issued recently a 43-page catalogue describing the Libby turret lathe. The characteristics of this lathe are fully described and data is given regarding the various sizes of lathes made by this company. Numerous illustrations are included, showing the different parts of the lathe. Particular attention is given to the Collet chuck and its construction, each of the individual parts being identified. Various other tools used in connection with this lathe are also illustrated and described.

BALL BEARINGS.—"Hess-Bright Ball Bearings—How to Apply Them," is the title of a booklet recently issued by the Hess-Bright Manufacturing Company, Philadelphia, for the purpose of showing what precautions should be taken to preserve the "inherent efficiency and superiority" of Hess-Bright ball bearings. The booklet emphasizes the necessity of clean bearings and proper lubricants, the care that should be taken to prevent overloading, and the necessities of proper mounting. A number of drawings are given to bring out the points in the text. Another and similar booklet issued by the same company deals with the application of ball bearings to the airplane.